MACHINERY

DESIGN — CONSTRUCTION — OPERATION

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PRINCIPAL ARTICLES IN THIS NUMBER

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DEPARTMENTS

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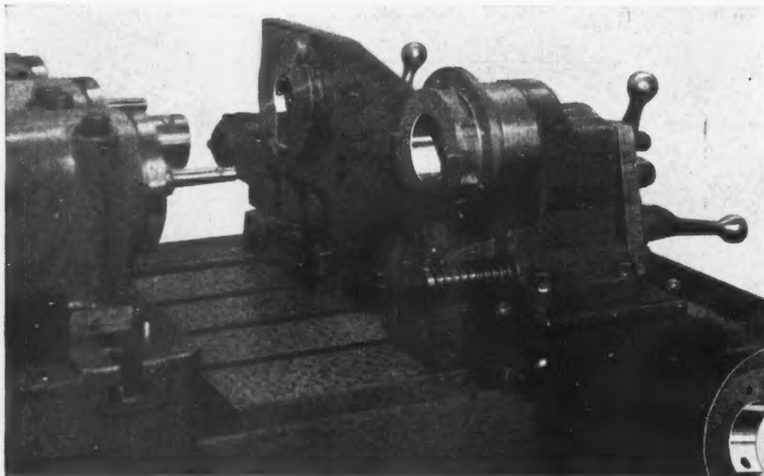

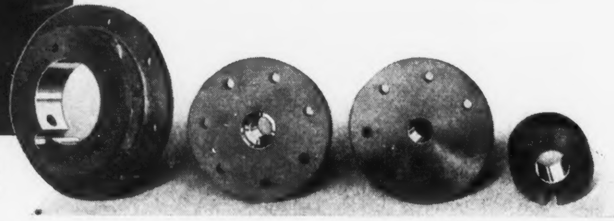

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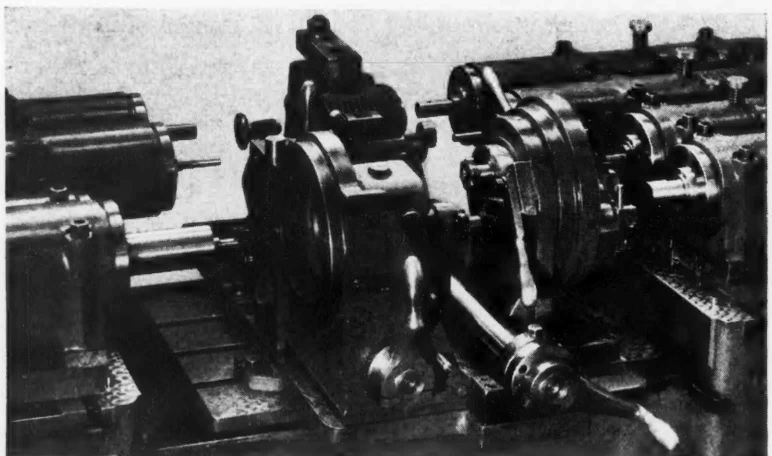

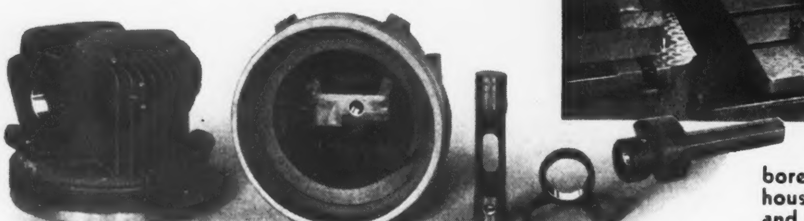

The double end Bore-Matic with eight spindles bores both cylinder bore and blind crankshaft hole in housing, piston pin holes, both holes in connecting rod and hole in each end of crankshaft.

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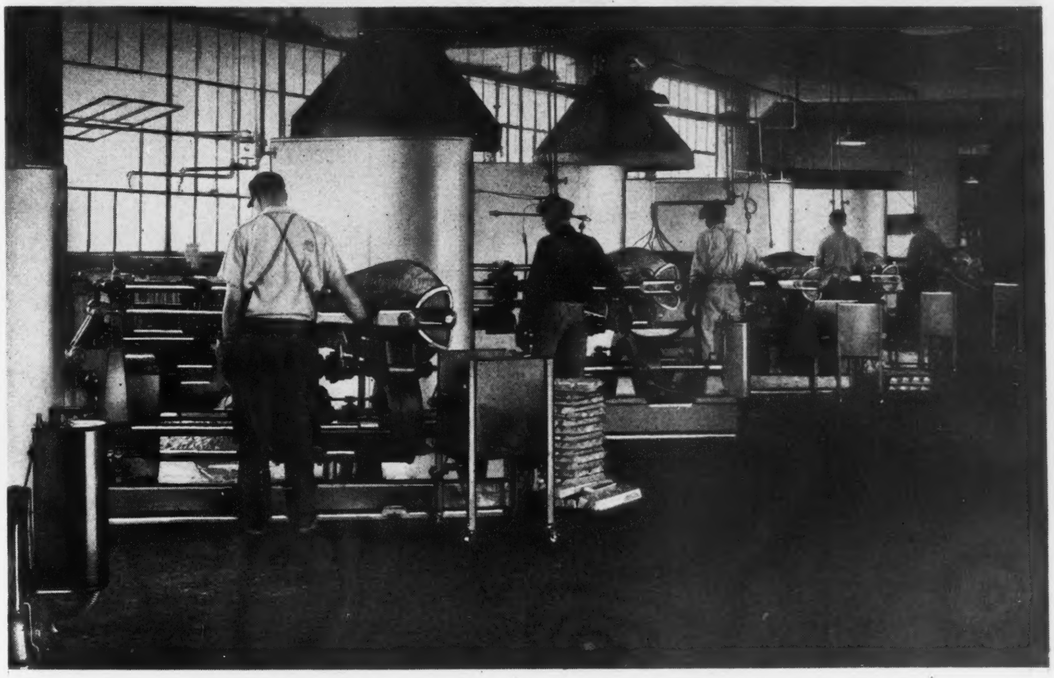


New Economies in Die-Casting

A Recently Developed System of Using Dies Consisting of Interchangeable Units Has Reduced Die Costs and Increased Production

By GUSTAV NYSELIUS

Mount Vernon Die Casting Corporation, Mount Vernon, N. Y.

THE cost of dies for producing die-castings has been greatly reduced, the time required for changing dies in the die-casting machine has become almost negligible, and production has frequently been quadrupled at the plant of the Mount Vernon Die Casting Corporation through the use of a recently developed method of die-casting termed "The Unit System." An important objective in developing this system was the reduction of the large investment required for die-casting dies.

With the conventional set-up, low cost per casting often necessitated the use of multiple-cavity dies. Such dies were expensive to make, even when the best modern methods of machining the cavities were employed. It appeared that the only way to reduce the cost of the dies was to find some way of using dies having, in general, only one or two cav-

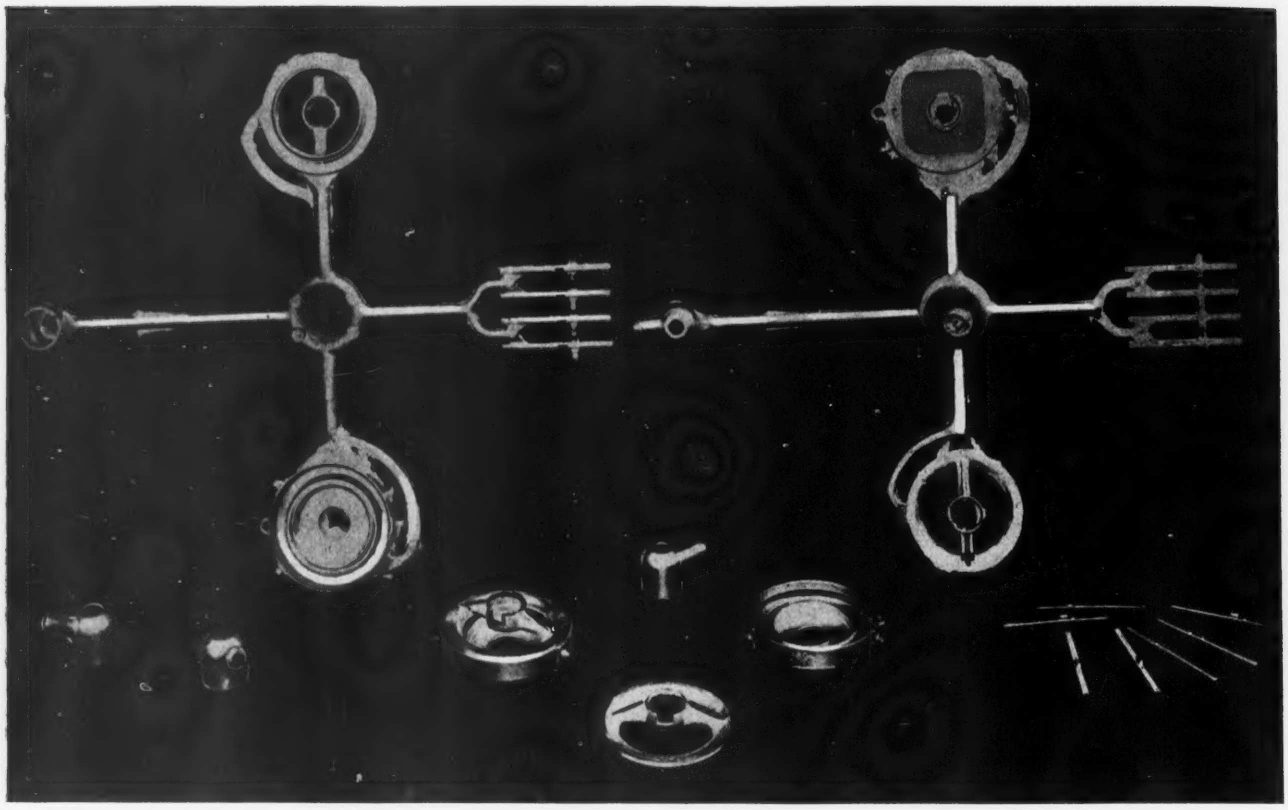


Fig. 1. Two Views Showing Both Sides of a Gate Made up of Four Different Kinds of Parts Just as They Come from the Dies Shown in Figs. 3 and 5. In the Lower Part of the Illustration, the Same Pieces are Shown after the Fins Have Been Removed. An Internal Thread is Cast in the Largest Casting by the Use of a Removable Core. The Small Bar-shaped Pieces are Only 1/32 Inch Thick

ities without sacrificing the productive efficiency of the multiple-cavity dies. This has been accomplished by the unit system.

It was found that the majority of dies did not need to be self-contained units, each with its own separate core slides and ejector parts. To make them in this form required large blocks of die steel and often a great deal of expensive machine work for core slides and means for actuating them. It became evident that only one pair of small single-cavity die-blocks would be needed for each part cast if several of these small die-blocks were mounted in a universal holder. A suitable holder was therefore devised, and as a result, the dies now used in this shop consist chiefly of single-cavity blocks, usually about 4 or 6 inches square and 2 inches thick, although the dimensions are not confined within these limits.

The cores are attached to permanent slides in the universal holder. The ejector-pins are mounted on a small plate which is clamped to the ejector-plate of the machine, and require no other guiding means. Consequently, all the die equipment the customer pays for—aside from the blocks containing the cavities, which, in themselves, are relatively inexpensive—are the simple core and ejector parts required.

By combining in a universal holder four or more dies, no two of which need be for the same piece, each die usually having only one or two cavities, the production economies of multiple-cavity dies are realized without the cost of machining multiple cavities.

By these means, the initial cost of the dies is often decreased as much as 30 to 70 per cent or more, depending on the character of the castings to be made. Figs. 3 and 5 show the rear and front holders of dies for producing four different parts. If necessary, arrangements can be made for drawing cores from four directions, or even at an angle to the usual drawing directions.

Machine is Kept in Constant Operation and the Handling of Small-Lot Jobs Facilitated through Quick-Change Feature of Die Units

The possibilities of more economical production do not end with the die itself. As all the parts of the die are made to fit the universal holder, the dies can often be changed in five minutes, whereas in ordinary practice, from two to four hours may be required, during which time the machine remains idle. This saving in time is of special significance

when orders are small and runs for a given die are correspondingly short. It never costs the die-casting manufacturer less than $5 in labor and idle machine charges to change an ordinary die, whereas the charges for corresponding changes with the unit system are almost negligible. Also, the unit type dies have the advantage of being small and relatively light in weight. Thus, one man can handle the dies easily and the storage space required is very small, compared with that required for ordinary dies.

Unit Die System Permits Economical Use of Larger Machines

Perhaps the greatest economy effected by the unit system relates not to the dies themselves, but to the method of using them in multiple arrangements so that four dies are filled simultaneously in the same time, or perhaps in an even shorter time, than would be required for filling an ordinary die, since a large and fully automatic machine is used.

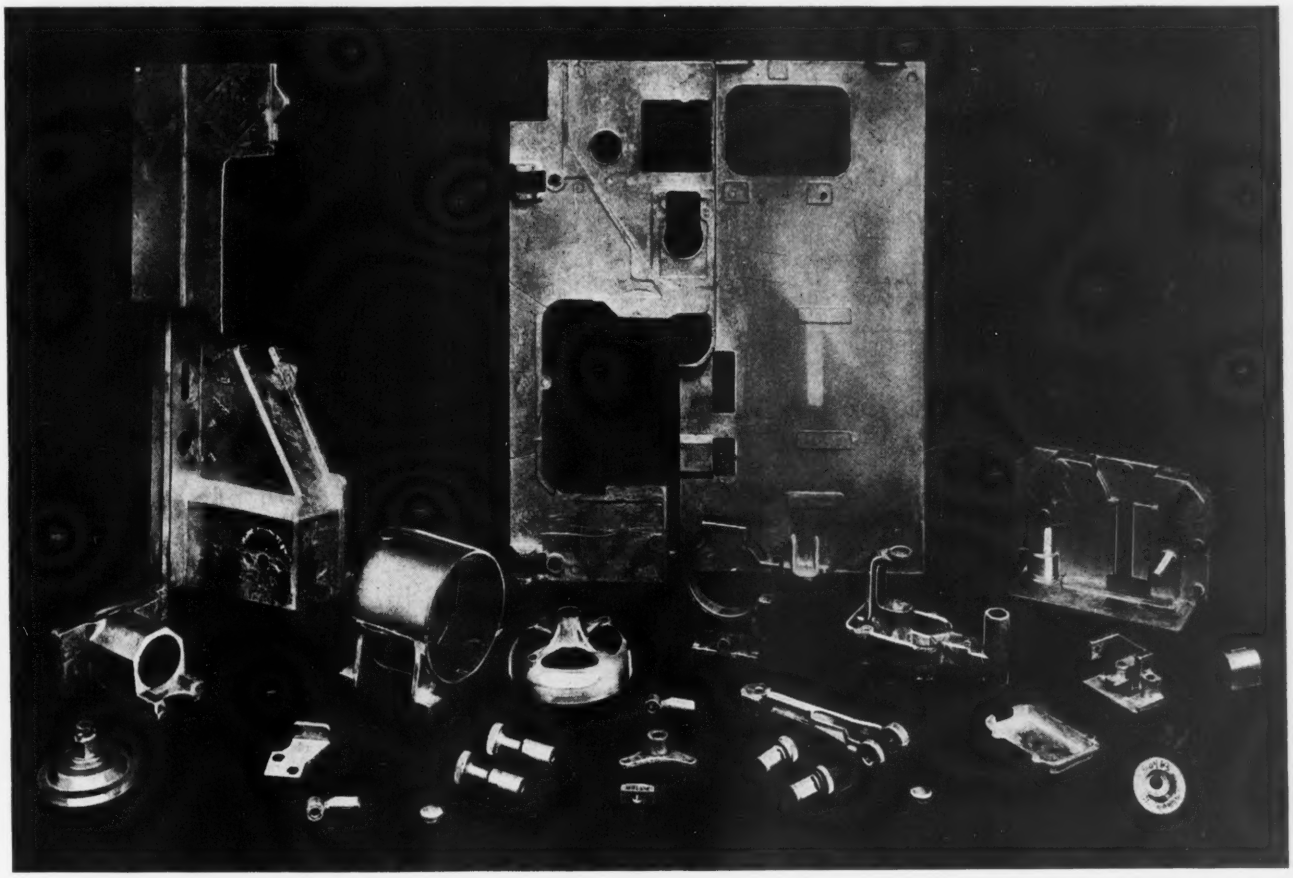
To effect this saving, the half for holding the blocks forming the die cavities is designed not to accommodate a single set, but as many as four sets of dies. Any one of these dies can be changed without affecting the set-up of the others or of the machine as a whole, and the arrangement is such that all the dies are filled at one "shot" of the machine.

Consequently, instead of producing one casting, or a set of castings in the case of dies having multiple cavities, four castings are produced at each shot. As the machine employed is capable of about 1500 shots per eight-hour day, it follows that with four dies in use, 6000 castings can be turned out in this period. The machine is readily operated by one man, and hence, the labor charge is correspondingly low.

Why the System is Particularly Efficient in Odd-Lot Production

It is not necessary that a run of the same number of pieces be made from each of the dies in use, for any one of the dies can be changed in a few minutes without disturbing the set-up of the other dies. What this means to a plant serving a large number of customers, any of whom may require a run ranging from a few hundred up to many thousands of castings from one die, can well be imagined. When

Fig. 2. Group of Die-cast Parts for Picture Projection Machine. All but the Largest Pieces in the Background were Made in Unit-system Dies. Many of These Parts Have Several Cored Holes or Cavities Produced by Cores that were Drawn Either Parallel to or at Right Angles with the Parting Face of the Die



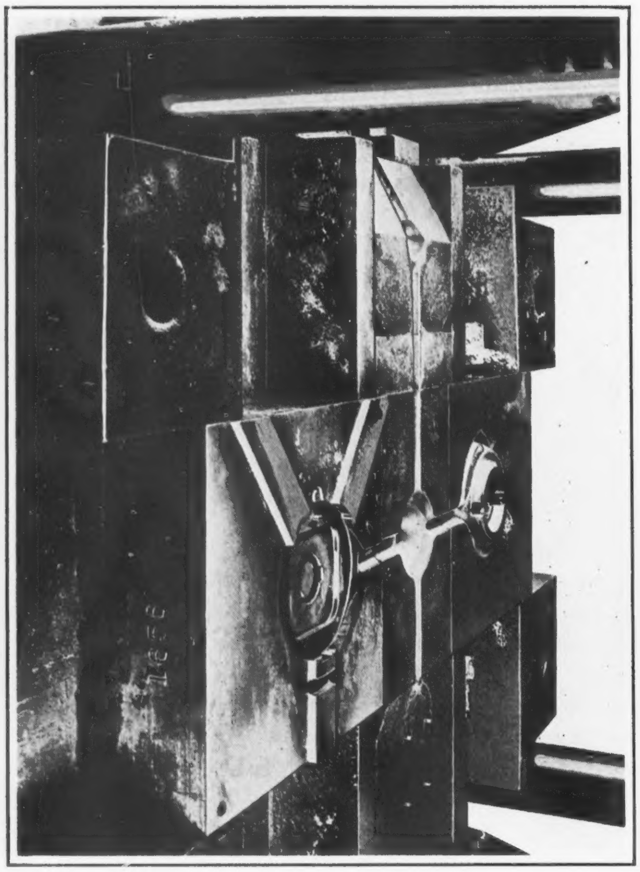


Fig. 3. (Left) Rear Half of a Set of Unit Dies and Their Holder. The Front Half is Shown Below. Provision is Made in This Instance for Drawing the Core of the Top Die at an Angle to the Parting Face. A Pair of Die-blocks can be Changed in about Five Minutes

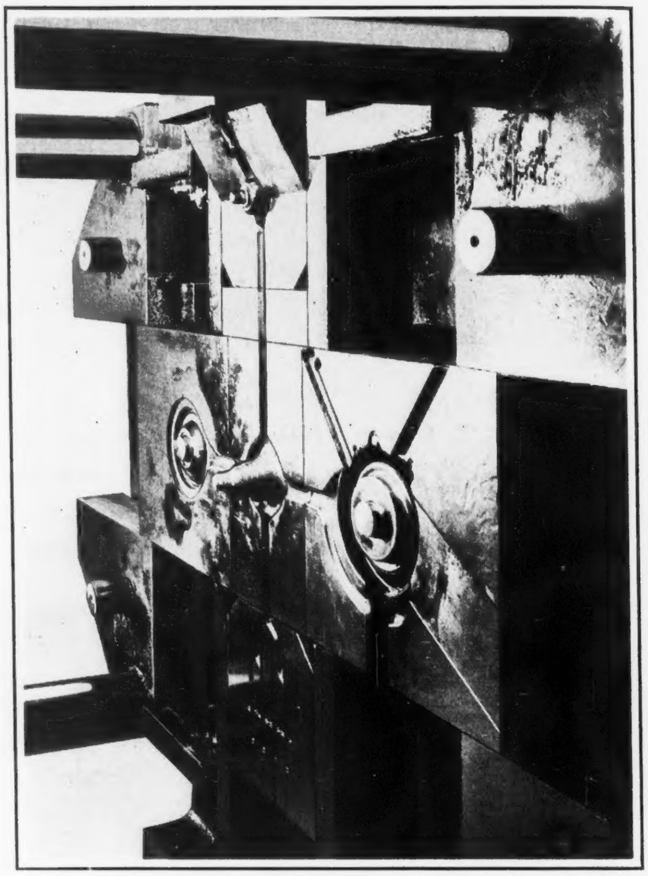


Fig. 4. (Below) A Pair of Single-cavity Dies Used with the Unit System, and a Pair of the Older Type Dies which Required Six Cavities to Make their Operation Profitable. The Single-cavity Die Used Simultaneously with Other Unit Dies is More Economical in Production and Much Less Expensive to Make

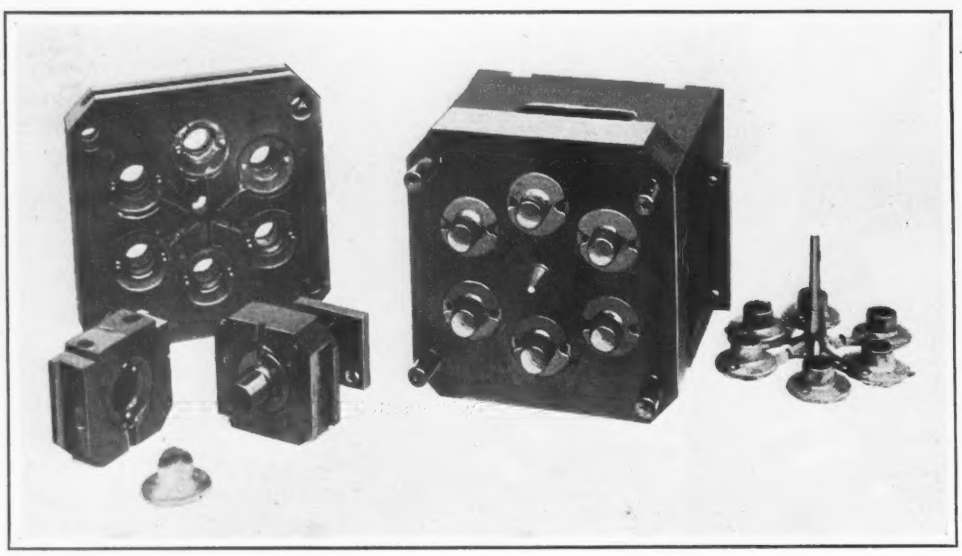


Fig. 5. (Above) Front Half of a Set of Four Dies in a Universal Holder Used in the Unit System. Four or More Die-castings are Made at One "Shot" of the Machine

short runs are common, and conditions such that customers order in hand-to-mouth quantities, the advantages are great, both to the customer and the manufacturer.

If, at any time, the orders on hand for different pieces happen to be less than the die capacity of a given machine, a blank die can be put in place of one or more dies, so that the other dies will still be productive. It is advantageous, however, to keep all the die spaces filled with dies from which castings are required, since, if any are blanked off, the hourly production rate is correspondingly decreased.

Features of Die-Holder Construction

Coming now to a more specific description of the die frame or holder, which might be adapted to almost any power-operated die-casting machine, it will be seen from Figs. 3 and 5 that this assembly consists of two major plates. These plates are about 20 inches high, 28 inches wide, and 4 inches thick and are attached to the front and rear heads of the machine. In closing the dies, the heads are moved toward each other by a hydraulically operated toggle mechanism.

In the holders shown in Figs. 3 and 5, there is provision for two 6-inch and two 4-inch dies, but in alternative arrangements for dies of larger size, space for only two dies is provided. It will be apparent, however, that various arrangements involving the same principle can be adapted to meet the requirements of the particular machine and size or placing of the dies.

Each of the die frames in the four-die machine is provided with a central gate-block. The block in the rear plate has a conical opening which registers with the nozzle of the pot containing the molten zinc or other metal being used. Mating with this is the block in the forward plate which has a conical projection that enters the hole in the rear gate-block when the dies are closed. This projection is made hollow for water-cooling, and clears the hole in the rear block, so that the molten metal has space to flow between the hole and the projection into the annular opening surrounding the hole and thence outward through four cylindrical gates, each of which mates with the gate of one of the four dies. The gate openings for the 6-inch dies are slightly larger in diameter than for the 4-inch dies.

Opposite each of the four sides of the two gate-blocks is a slot that measures 4 inches and 6 inches across and is 2 inches deep. Into these slots the die-blocks fit, their faces at the parting line being flush with the parting between the two gate-blocks. Of course, the forward half of each die is fastened to the forward plate, and the rear half to the rear plate.

The slots for holding the dies are only half as deep as the plate, but the metal under the slot is mostly cut away, so that the die rests only against a ledge and its back face is almost clear, allowing the ejector- and core-pins to enter as required. Although the thickness of the die halves is normally only 2 inches, a part of the die can be allowed to project through the opening below the slot if a deep cavity is required.

The die-blocks are made of a standard 4-inch or 6-inch width, so as to fit the corresponding slots, but they can be almost any length, parallel to the slot, that the plate can support and hold tight at the parting line when the dies are closed.

Methods of Operating Ejector-Pins and Cores

Ejector-pins and cores that are pulled parallel to the axis of the machine, that is, at right angles to the parting plane, are operated through a rack and pinion device in conventional fashion, the cores by stops engaging with a lever on the pinion shaft, and the ejector-pins by a hand-operated lever.

Cores to be pulled in a plane parallel to the parting plane are actuated by vertical core slides that fit into 4-inch slots at each side of the central slot for the 4-inch dies. These slides are actuated, in turn, by square-section bars fixed to the machine. Inclined surfaces on the bars contact with rollers on the slides, so that the slides are reciprocated as the heads of the machine move longitudinally. These slides serve only the 6-inch dies; hence castings that have transverse cores are confined to the 6-inch slots. Cores are sometimes operated at an acute angle to the axis of the machine when this is required.

Since all essential outside dimensions of the die-blocks are held to a standard that will fit the corresponding recess in the holder, the dies are quickly and easily changed. The holders are accurately machined and firmly attached to the heads of the machine, which are reciprocated on close fitting hardened bushings that maintain accurate alignment; hence it is not even necessary to have dowel-pins in the two halves of the die. These halves are simply set into recesses and locked with taper pins that hold them securely and insure tight joints at the parting. Slides carrying cores and plates with cores and ejector-pins are placed with equal facility, so that set-up and removal operations are easily and quickly performed.

Alloys Used for Die-Castings

Besides standardizing, as far as possible, on die dimensions, it is the practice in this plant to use a standard alloy, so as to insure uniformity in castings and to avoid the need for special metal stocks and meltings. The alloy most used is Zamak-2, which contains about 4 per cent aluminum, 3 per cent copper, and 0.05 per cent magnesium, the remainder being Horse-Head special zinc. This alloy has a tensile strength of about 49,000 pounds per square inch.

Aluminum-base castings are also made by the unit process, when light weight and other considerations demand it, but the higher temperatures re-

quired necessitate the use of alloy steel dies, which are more expensive than the forged machine steel used for zinc-base castings. In other respects, however, the method in question is of equal utility and makes for greater economy, whether the castings are of zinc or aluminum.

It is not claimed that all die-castings lend themselves to production by the unit system. Castings with exceptional core work or those of quite large size may require special treatment which cannot be readily applied with the standardized universal holder used with the unit-system dies. With a very large die it may not be feasible to fit more than one die into a machine at one time, and in such cases, some of the advantages of the unit system may have to be sacrificed. When many large dies are in fairly regular use, however, and the core work is not unusual, it is still possible to make material gains in die construction by using a universal frame, so that each die does not have to be a self-contained unit with its own core slides and core-actuating mechanism and does not have to be used alone in the machine.

It is evident in any case that the unit system for the average run of dies brings economies that are much too important to be overlooked or sacrificed. These economies, it is believed, will materially extend the field for die-castings by making them feasible in many cases where the high cost of dies formerly militated against their use.

The Common Sense of Technocracy

Much has been said in the name of Technocracy that has not been based on the findings of the body of men who have undertaken the very broad investigation into industrial facts that is identified with this name. Fortunately, there has recently been a clarification in the relation of Columbia University to the investigations of Technocracy. In Professor Walter Rautenstrauch, of the Industrial Engineering Department of the University, this group of men has now a leader who can be depended upon to carry on the investigations with a view to bringing out important facts without seeking to draw sensational conclusions. The value of this research will doubtless assume an importance that earlier statements by less qualified men did not indicate.

The following summary of the objects with which Technocracy is concerned is abstracted from an address delivered by Professor Rautenstrauch before the Institute of Arts and Sciences at Columbia University.

Briefly, the organization known by the name Technocracy is concerned with: (1) A statistical study of the natural resources of the North American Continent and their rate of consumption and use during the last hundred years; (2) the changes that have occurred during this period in the processes by which natural resources are converted into commodities, particularly as these changes affect the labor of man and the use of energy; and (3) the forms of organization and management by which the processes of production and of distribution of wealth are controlled and adjusted to human needs.

Professor Rautenstrauch makes it very clear that it has never been the thought of the serious-minded men in the organization that the country should be "run by engineers." To use his own words: "Technocracy does not state that the country should be run by engineers. It is not interested in promoting any *legal* controls by any group of persons or class. What it does hold is that the . . . social mechanism should be designed according to the function to be performed and with a knowledge of the materials and forces available for use. It states that the methods of procedure in design, which the technologist and engineer use, are the kind of methods which should receive consideration in designing and operating the social order. Technocracy wonders why there should be such a resistance to the application of the engineering method of approach, after it has proved its immense worth in providing us with such abundant opportunities for well-being, and why the systems of operation and control which have brought almost every nation to the brink of bankruptcy should receive such unwarranted approval and support.

"Technocracy holds that there are no patent medicines for the ills of the world—nor does it offer any. We hope that the transition to a new order of society may be orderly, intelligent, and constructive, as becomes a people of great culture and stability. While mankind has won religious freedom and political freedom in times past at great cost, let us hope that it may win economic freedom by intelligent cooperation and orderly processes of reconstruction."

* * *

Foundrymen to Hold Convention and Exposition in Chicago

The annual convention of the American Foundrymen's Association will be held at the Stevens Hotel in Chicago, June 20 to 23. In connection with the convention, an exposition will be held in the Exhibition Hall of the Stevens Hotel, where products and improvements in foundry equipment will be shown and demonstrated. During the convention, sessions will be devoted to steel, gray-iron, malleable-iron, and non-ferrous foundry practice. Costs will also be discussed, and papers on sand research and materials handling will form part of the program. C. E. Hoyt, 222 W. Adams St., Chicago, Ill., is executive secretary of the Association.

Simplified Method of Plotting a Gravity Cam Curve

By A. S. KINGMAN

A GRAVITY cam is so proportioned that it drives its follower at a constantly increasing speed during the first half of its throw and at a constantly decreasing speed during the last half. The rate of increase and decrease corresponds to the acceleration due to gravity. It appears that almost every time a cam is required for high-speed work, the harmonic or crank curve is used, because it is easier to lay out. This is done, in spite of the fact that the gravity curve is conceded to be the best curve for speed work. It is the purpose of the writer to show how to make a simple straight-line diagram from which a correct gravity curve can be plotted in less time than it takes to plot the harmonic curve by the usual method.

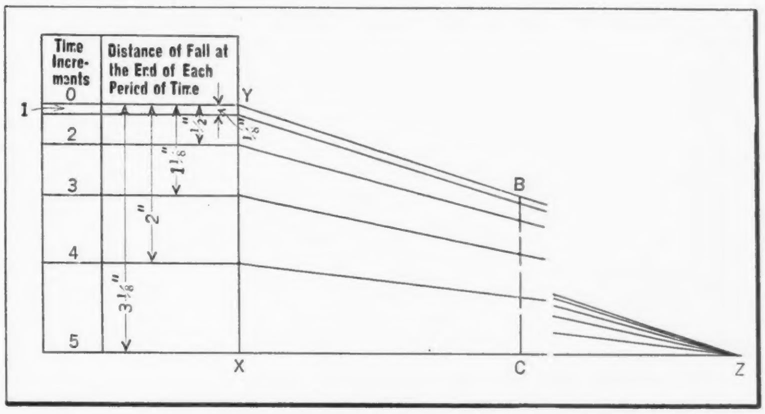


Fig. 1. Simple Diagram to Facilitate Plotting a Wide Range of Gravity Cam Curves Like that Shown in Fig. 2

This diagram is constructed as follows: Draw the vertical line *XY*, Fig. 1, exactly 3 1/8 inches long and divide it accurately, as indicated. Next, draw horizontal line *XZ* about 10 inches long. This length is not important, any convenient length being satisfactory. Finally, draw the angular lines from point *Z* to each division on line *XY*, as indicated. The diagram is now ready for use. All the lines and notations at the left of line *XY* are to show the construction of the diagram and are not used in plotting a cam.

To illustrate the use of the diagram, assume that a cam of 4-inch throw is required. On the diagram draw a vertical line *CB*, which is located so that its length is exactly 2 inches, or one-half the cam throw. Next, assume that the cam circumference is to be 7 inches. Draw two horizontal lines, as indicated in Fig. 2, 7 inches long and exactly 4 inches apart, and a third line *DE* half way between the two. Now draw eleven vertical lines, dividing the 7-inch lines into ten equal parts, and number them as indicated.

Referring to Fig. 1, with one leg of the dividers set on *XZ*, take the distance along line *CB* to the first angular line below *BY*, and transfer it to Fig. 2 as follows: With one divider point on *DE*, mark the distance above *DE* on vertical line 1 and on the vertical line 9 below *DE*. Again referring to Fig. 1, take the distance from *XZ* to the second angular line below *BY*, and transfer it to Fig. 2 on vertical lines 2 and 8, in the same way as before. Continue transferring the distances between *XZ* and the successive angular lines in Fig. 1 to the corresponding vertical lines on the diagram Fig. 2.

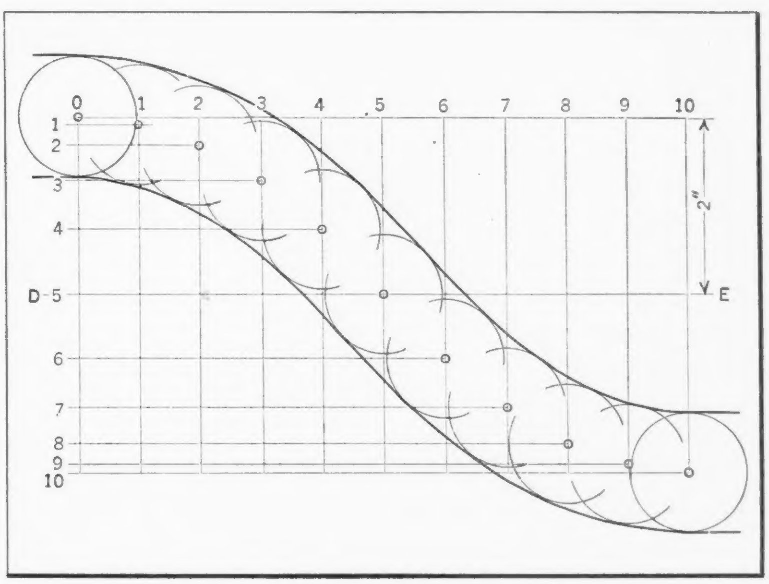


Fig. 2. Gravity Cam Curve Plotted Rapidly from the Diagram in Fig. 1

The points thus located on the vertical lines indicate the path of the center of the cam-roll, and the contour of the cam groove is found by drawing two smooth curves tangent to the roll circles. Horizontal lines are drawn from the roll centers to the left. It will be found convenient to number them for reference, as they indicate the amount of cam throw at the end of any given increment of time.

The dimensions used for the diagram in Fig. 1 are arbitrary and were chosen because they are convenient to compute and use. Their derivation is as follows: It will be seen that the fall from 0 in the first period of time is 1/8 inch; at the end of the second period, 1/2 inch; at the end of the third period, 1 1/8 inches; at the end of the fourth period, 2 inches; and at the end of the fifth period, 3 1/8 inches.

According to the formulas for the acceleration of falling bodies, the distance fallen varies with the square of the time; hence the preceding figures are obtained by multiplying 1/8 inch by the square of the increments of time, thus: $1/8 \times 1^2 = 1/8$ inch; $1/8 \times 2^2 = 1/2$ inch, etc. The diagram can be used for any gravity cam lay-out for throws up to and including 6 1/4 inches by locating the line CB so that its length equals half the required cam throw.

If a cam is required with a greater throw or the designer wishes to divide the cam into a greater number of parts, a diagram to suit can be computed as follows: Let F equal the fall in the first period of time, and G, which is one-half the cam throw, the fall in the last period of time. Divide the horizontal lines (Fig. 2) into any even number of equal parts—for example, sixteen instead of ten as shown. The time increment column will then have eight spaces on the new diagram numbered consecutively from 1 to 8. Then:

$$F = \frac{G}{8^2}$$

At the end of the second period, the fall will be equal to $F \times 2^2$; at the end of the third period, $F \times 3^2$; at the end of the fourth period, $F \times 4^2$; at the end of the fifth period, $F \times 5^2$; at the end of the sixth period, $F \times 6^2$; at the end of the seventh period, $F \times 7^2$; and at the end of the eighth period, $F \times 8^2 = G$. These values give the spacing on line XY for the new diagram.

A Manufacturer Who Has Faith in the Future

While the machinery industries have been affected by the business depression to a greater extent than any other important branch of manufacture in the United States, it is remarkable to note the confidence that many machine builders have in the future. In one plant we find that advantage has been taken of the present conditions to place the shop in what might be well termed an ultra up-to-date condition—90 per cent of the equipment has been installed during the last three years. This equipment represents the latest developments in engineering, many of the machines being provided with welded-steel bases, hydraulic feeds, and other features designed to decrease costs and improve the methods of operation.

This manufacturer states that his faith in the future of his own business results from his knowledge of the conditions in his competitors' plants; they are equipped with obsolete machinery of obsolete design!

In commenting upon what has been done in this plant, the president of the company says: "We do not feel that we should be complimented on our enterprise in installing new machinery, new testing equipment, new office equipment, new foundry, etc. We feel that this procedure was and is necessary for the permanence of our institution, just as much as it is necessary to carry insurance on our physical assets.

"We believe that only those manufacturers who are equipped with every modern facility for production and sales will weather the storm. Only the future will tell the wisdom of our program, but we would rather lose the battle after some years of constructive effort than to sit and patiently wait for good times to return and thereby dissipate our funds in overhead as a result of no sales.

"Along with the new equipment program, we have developed a complete new line of the machines that we build. The wisdom of this procedure is obvious, because a review of our 1932 sales showed that 85 per cent of our sales were of machines of our latest design."

And now for the conclusion: What have been the results? The plant, due to the improvements made, increased its business, measured in tonnage, in 1932 over that of 1931. It nearly doubled its proportionate share of the business in the industry in which it is engaged; and although selling prices decreased 25 per cent, there was no reduction in the percentage of gross profits. All this is very conclusive evidence of the fact that up-to-date equipment, modern manufacturing methods and an aggressive sales policy make it possible, even in these days, to forge ahead.

* * *

New Cement Finds Many Uses

A porcelain cement paste that can be widely employed in production assembly work for holding small parts in place, thereby doing away with the usual nuts, screws, and metal solder, and for filling holes and cracks in metal as a sealing compound has been developed by Henry L. Crowley & Co., West Orange, N. J. The cement can also be employed for plumbing fixtures and tile work. Another new development is a dipping cement for coating electrical resistors and radio coil forms. This cement can also be used for general adhesive purposes. It sets in a short time without the application of heat, is proof against water, oil, acids, gases, and temperatures up to 2000 degrees F., and is a good electrical insulator.

LOAD CAPACITIES OF RADIAL BALL BEARINGS—SINGLE-ROW LIGHT TYPE—1

Bore Diameter, Millimeters*	Outside Diameter, Millimeters*	Width, Millimeters*	Range of Ball Diameters, Inches	Number of Balls	Speed of Inner Ring, in Revolutions Per Minute, and Approximate Range of Load Ratings, in Pounds, for Different Makes†			
					100	500	1000	3000
10	30	9	7/32–1/4	7–8	350–500	200–300	150–250	100–175
12	32	10	7/32–1/4	8–10	400–650	225–375	175–300	100–200
15	35	11	7/32–1/4	9–10	450–800	275–475	225–350	100–250
17	40	12	1/4–9/32	8–11	550–980	350–600	275–450	125–300
20	47	14	1/4–11/32	7–13	650–1250	400–775	325–500	150–330
25	52	15	1/4–5/16	9–14	780–1400	450–825	375–650	200–450
30	62	16	5/16–11/32	13–15	1050–2100	625–1255	480–1000	260–690
35	72	17	11/32–13/32	13–14	1450–3050	850–1800	670–1400	370–980
40	80	18	3/8–7/16	14–16	1720–3650	1000–2150	800–1700	450–1180
45	85	19	3/8–7/16	15–18	1920–3960	1120–2320	880–1840	530–1250
50	90	20	3/8–1/2	14–20	2100–4400	1220–2580	960–2040	600–1400
55	100	21	7/16–17/32	15–18	2640–5100	1550–2980	1220–2370	730–1600
60	110	22	7/16–9/16	16–21	2660–5650	1560–3300	1230–2600	850–1800
65	120	23	1/2–5/8	16–20	3250–6500	1900–3800	1500–3000	980–2080
70	125	24	1/2–5/8	16–22	3550–7050	2070–4120	1640–3770	1080–2260
75	130	25	1/2–11/16	16–22	3930–7950	2300–4450	1820–3530	1250–2400
80	140	26	5/8–3/4	15–18	4270–8700	2500–5090	1980–4040	1370–2800
85	150	28	11/16–3/4	16–18	5040–9400	2950–5500	2350–4380	....
90	160	30	11/16–13/16	16–20	5400–10500	3150–6200	2500–4900	....
95	170	32	3/4–7/8	16–18	6200–11780	3630–6900	2870–5450	....
100	180	34	13/16–15/16	16–18	7060–13000	4120–7740	3300–6000	....
105	190	36	7/8–1	16–18	7100–14200	4150–8800	3300–6800	....
110	200	38	7/8–1 1/16	16–18	7700–15500	4500–9300	3600–7300	....

*For converting millimeters into inches, see table on page 1538 of MACHINERY'S HANDBOOK, sixth and later editions.
†Load ratings of commercial bearings vary considerably for different makes. This table is intended only as a general guide in preliminary designing. The exact rating should be obtained from the manufacturer of whatever bearing is to be used.

MACHINERY'S Data Sheet No. 247, New Series, April, 1933

LOAD CAPACITIES OF RADIAL BALL BEARINGS—SINGLE-ROW MEDIUM TYPE—2

Bore Diameter, Millimeters*	Outside Diameter, Millimeters*	Width, Millimeters*	Range of Ball Diameters, Inches	Number of Balls	Speed of Inner Ring, in Revolutions Per Minute, and Approximate Range of Load Ratings, in Pounds, for Different Makes†			
					100	500	1000	3000
10	35	11	1/4	7–8	350–630	250–350	200–280	80–190
12	37	12	1/4–9/32	7–10	450–750	320–440	240–350	100–240
15	42	13	1/4–5/16	7–11	550–890	380–520	300–400	120–280
17	47	14	5/16–11/32	7–10	780–1090	540–630	420–480	170–330
20	52	15	5/16–13/32	9–12	1000–1460	700–850	550–680	230–470
25	62	17	3/8–13/32	8–12	1300–1970	920–1140	720–900	300–630
30	72	19	7/16–15/32	8–12	1660–2600	1160–1430	900–1140	370–780
35	80	21	1/2–17/32	8–12	2170–2800	1520–1900	1180–1300	480–900
40	90	23	9/16–19/32	8–12	3000–3900	2060–2320	1460–1630	660–1100
45	100	25	5/8–11/16	8–12	3800–4650	2230–2850	1760–2200	900–1300
50	110	27	5/8–23/32	8–12	4270–4700	2500–3200	2000–2400	1000–1500
55	120	29	11/16–25/32	8–13	5050–7000	2950–4000	2350–3100	1270–1700
60	130	31	3/4–27/32	8–13	5220–8200	3050–4800	2450–3600	1500–1900
65	140	33	13/16–29/32	8–13	6750–9100	4000–5400	3140–4200	1700–2100
70	150	35	7/8–31/32	8–13	7700–10000	4500–6300	3470–4900	2000–2400
75	160	37	7/8–1	8–13	7700–10200	4500–7100	3600–5500	2250–2550
80	170	39	15/16–1 1/16	8–13	8700–11500	5100–8000	4000–6200	2500–2800
85	180	41	1–1 1/8	8–13	9500–14000	5560–9000	4400–7000	2800–3000
90	190	43	1–1 3/16	8–13	9700–14400	5700–10000	4500–7800	3100–3300
95	200	45	1 1/8–1 1/4	8–13	11900–18000	6500–11000	5200–8700	....
100	215	47	1 1/8–1 1/2	8–12	12000–20000	7000–13600	5550–10600	....
105	225	49	1 1/4–1 7/16	8–13	13500–22000	8000–14800	6300–11500	....
110	240	50	1 1/4–1 1/2	8–13	14400–23000	8400–16000	6700–12500	....

*For converting millimeters into inches, see table on page 1538 of MACHINERY'S HANDBOOK, sixth and later editions.
†Load ratings of commercial bearings vary considerably for different makes. This table is intended only as a general guide in preliminary designing. The exact rating should be obtained from the manufacturer of whatever bearing is to be used.

MACHINERY'S Data Sheet No. 248, New Series, April, 1933

How to Obtain Best Results in Roll-Grinding

Fourth of a Series of Five Articles Giving Complete Directions for Roll-Grinding Operations and Wheel Selection

By H. J. WILLS, Engineer
The Carborundum Co., Niagara Falls, N. Y.

THE third article of this series, published on page 437 of March MACHINERY, dealt with the grinding of steel rolls, chilled iron rolls, jewelers' rolls, chromium-plated rolls, and paper-mill rolls. The present installment will give specific directions for the grinding of rubber rolls, steckel-mill rolls, foil rolls, and copper rolls for intaglio printing.

The Grinding of Soft Rubber Rolls

The grinding of soft rubber rolls involves some radical departures from the practice of grinding metal rolls, due to the tendency of the rubber to "load" the wheels and the heat generated by the tearing action of the wheel. In plants where there are many kinds of rolls to be ground, but few of rubber, it is possible to use wheels that are commonly employed for chilled iron, brass, etc., but it is better and more economical to use special wheels operated under conditions more suitable to rubber roll grinding.

General practice would indicate that coarse-grit, Redmanol-bonded, silicon-carbide wheels are best for this purpose, as they operate quite free of loading and have a rapid heat dissipation. Narrow effective wheel faces are recommended.

Proper dressing will eliminate loading to a large extent. A sharp star dresser or a coarse abrasive stick should be used. Frequent cleaning of the wheel face with a stiff wire brush is recommended.

High wheel speeds are recommended. Redmanol-bonded wheels permit the use of speeds between 7500 and 9500 surface feet per minute. The work speed must be low, and should be selected to meet local conditions.

Cooling Work and Wheel while Grinding

Most operators prefer dry grinding. In this case, any of the following methods of cooling the wheel and work will be found practical:

1. Fan or blower. Have the air stream directed so that it strikes a large portion of both wheel and roll.

2. Suction. A strong suction nozzle, placed directly under the point of contact, is very effective. For this, a portable vacuum cleaner may be used. Combined with a fan or blower, this arrangement is very good.

3. Self-ventilation. Where neither air blast nor suction is practicable, it is suggested that a wide-faced wheel be used having the center of the face under-cut to a broad "U." For example, a 2-inch face wheel can be under-cut with a dresser in such a manner that there are two faces presented, each 1/2 inch wide, the center having a clearance of 1/2 inch. This arrangement creates a down draft between the wheel and work.

If conditions permit, wet grinding is advantageous in that the grinding is smoother than dry grinding and solves the cooling problem. The wheel also has less tendency to become loaded. Plain water is recommended. It is further recommended that the wheel edges be well rounded to reduce the cutting area of the wheel and to prevent deep traverse marks. Heavy cuts should be avoided at all times, and a slow rate of wheel traverse used. For finishing, the roll should be driven at the maximum safe speed and smoothed with aluminum-oxide coated cloth in 50 grit and polished with 150 grit. In both cases, the roll should be well covered with powdered soapstone during these operations.

Grinding Hard Rubber Rolls

Hard rubber rolls offer little difficulty in grinding and are usually treated as a conventional roll-grinding job, except that they are generally finished with aluminum-oxide coated cloth in the same manner as soft rubber rolls. It is important that the dressing be done with a good diamond and that the edges of the wheel be well rounded. Coolants must be filtered.

The Grinding of Steckel-Mill Rolls

The grinding of steckel-mill rolls presents totally different problems from those met in grinding other hardened steel rolls in that they are forged from high-speed tool steels, of small diameters and proportionately wide bodies. The nature of their mounting and the class of service to which they are put make it essential that they be ground to a very high degree of accuracy and concentricity. The surface is equally important, but high polish is not required.

The first and most important requirement in grinding these rolls is rigidity of the grinder spindle, headstocks and tailstocks, and foundations. The ways should be true and free from "give." Vibration of any of these machine elements is fatal to the quality of surface required. The spindle bearings should be of the sleeve or cap type, and set up with a minimum oil clearance.

The lubrication of the spindles must be of the best—the oil clearance must be entirely filled with

oil which must be of a quality that will not thin down too much under heat. Owing to its coefficient of expansion, a high grade of babbitt metal makes the best bearing material. Both spindle and bearings should be lapped individually and together with a lapping compound as fine as "H-41 Fine," and then burnished with white lead and oil to insure a close fit.

The machine roll-centers should be lapped carefully when these rolls are ground on centers. It is suggested that the roll-centers be extra large, and that not more than one-half of their depth be utilized as a bearing, since this type of roll-center insures a minimum of error. A rigid back-rest or stop is likewise essential.

It is feasible to mount steckel rolls on neck-rests, provided the rest construction insures freedom from vibration and good lubrication. The rests should be rigidly mounted on the grinder bed and a positive-acting cap or clamp should be used to hold the roll in place. They should also have corner radii to correspond with the roll necks.

The Grinding of Foil Rolls

With the single exception of jewelers' rolls, the grinding of rolls for foils demands the greatest care of all roll-grinding to produce dimensional tolerance, surface perfection, and high finish. In these rolls, the three qualities are definitely related and inseparable. Finish can in no way be substituted for surface perfection in this class of grinding. Correct dimensions must be first attained and a fine surface generated; not until then should finish enter into the process, and then only as a final operation. Although the method of procedure in grinding foil rolls involves no unusual manipulation, the controllable factors that insure quality in grinding should be carefully taken into account.

Finishing Copper Rolls for Intaglio Printing

The preparing of copper cylinders for etching for intaglio printing is a simple process, yet it involves much patience and extreme care in order to obtain a satisfactory surface at a minimum of time and expense. It is imperative that a form of abrasive be selected that will remove the required amount of stock from the cylinders quickly without producing deep scratches. The abrasive must have no hard spots or coarse grits that may gouge the surface and waste the time and expense already given to the preparation of the rolls.

The grinders used may include a standard cylindrical grinder for rough-grinding, cylinder-truing, or etching removal; and a special grinder, consisting of a vertical wheel-spindle on a traveling head, utilizing the side of the wheel instead of the periphery, for finishing. The latter type of grinder may have eccentric or concentric wheel movement.

The first essential to good finishing of copper cylinders is cleanliness of the grinder, air, water, and wheel. Even when grinding hardened steel, cleanliness is of the utmost importance. Since copper scratches much more readily than steel, the presence of dirt will destroy the surfaces of intaglio rolls.

All grinders should be maintained in the best possible condition. The spindles, ways, and bearings, if loose or faulty, will cause poor grinding. The grinders must be firmly mounted on solid foundations. Oil and grease on the rolls will seriously affect the cutting qualities of the grinding wheels.

Clean water is best for flushing and cooling, as oil or soda solutions are injurious to this class of grinding. If the roll is run in a water trough, it is best to change the water frequently, and particularly when changing to finer grit wheels. It is very strongly recommended that water supplied from the city water system be filtered through several thicknesses of fine cambric cloth, as sand is present in some water systems.

Wheel Feeds and Speeds for Copper Roll Grinding

All stages of finishing are best carried on with very fine wheel feeds, diminishing as the work progresses. Roughing cuts should be made with positive feeds, in order to acquire or maintain roundness or parallelism. Semi-finishing cuts may be made with a floating or gravity feed, while the finishing cut should be made only with gravity feed.

Roughing and semi-finishing wheels operate best with a concentric movement, and finishing wheels with an eccentric or oscillating movement. The latter movement effectively crosses all lines and tends to reduce chatter. However, it is desirable on the semi-finishing and finishing cuts to make one final pass with a concentric wheel movement and a light feed to reduce the "pattern" from the eccentric motion.

In using a concentric motion, it is desirable to have the wheel-spindle centered with the center line of the cylinder, as otherwise scratches may occur from the edges of the "stone" hole, especially if these edges are not properly rounded off.

The special wheels used for this type of grinding, known as "Intag" wheels, may be operated at any speed, but it should be kept in mind that at higher speeds the wheels act harder and finer. In all cases, the wheel speed must be kept well under the chatter or vibration point. At 100 revolutions per minute, the surface is frosty in appearance, showing very short circular marks, while at 500 revolutions per minute it has a decided shine, with the lines long and straight. On account of this polish, even the faintest lines are thrown out in sharp relief, giving a false impression of depth.

Regardless of the speed and whether or not the spindle is concentric, there is a natural tendency for one-half of the wheel face to do most of the cutting. This cutting side must, in all cases, run coun-

ter to or against the direction of rotation of the cylinder, except when there is a tendency to "fish-tail," in which case the wheel rotation should be reversed.

Work and Traverse Speeds for Copper Roll Grinding

Considering the wheel grading, the rolls should turn at the maximum speed possible without vibration, since the higher work speeds tend to minimize the grinding marks and flat spots. If the work speed is too slow when an oscillating movement is used, the wheel does not touch the entire cylinder periphery, causing high and low spots. Traverse speeds are relatively unimportant, except that the wheel life is somewhat lengthened by slower traverse speeds. One-fourth inch traverse per cylinder revolution is very satisfactory. In traversing the wheel with any kind of feed, it is important not to have the wheel pass beyond the end of the work more than three-fourths its face.

Wheel Gradings and Wheel Selection

If too soft wheels are used, the wheel wear may be excessive and the cylinders may be marked with "fish-tails"; if too hard, the wheels will not cut properly.

Softness of grading can be offset largely by increasing the wheel speed, slowing up the work speed, or decreasing the wheel traverse and lessening the wheel pressure. Hardness of grading can be counteracted by decreasing the wheel speed, using greater pressure, enlarging the wheel hole, increasing the work speed, and decreasing the wheel traverse.

In selecting wheels for cylindrical grinders, coarse grits should be avoided for rapid stock removal, as considerable time is required to eliminate the grit marks caused by such wheels in subsequent operations. Since this class of grinding requires wheels to suit the grinder as well as the work, no general wheel recommendations can be made.

In selecting wheels for special grinders, two cases are to be considered: Base and solid cylinders are subjected to three operations—roughing, smoothing, and polishing for which "Intag" wheels designated "roughing," "semi-finishing," and "finishing" are used, respectively.

Ballard-shell cylinders require two operations—smoothing and polishing; for these, "Intag" wheels known as "semi-finishing" and "finishing" are used, respectively. All these wheels are 7 3/4 inches in diameter by 3 inches wide and have a 2-inch hole.

How to Avoid Scratches

Any stock removed will cause scratches and no ground surface can be absolutely free from them. It may be well to consider the various kinds of scratches, in order to trace the causes should they be objectionably deep.

Typical scratches or normal cutting marks are rather short and are in the form of a narrow valley in a flat surface or plateau. The sides of the valleys do not rise above the surrounding plateau. Long scratches, broad but shallow, are from grits "pulled" from the wheel. These can be prevented by proper trimming of the wheel edges, less wheel pressure, or higher wheel speeds. Irregular long scratches, having a torn appearance at the bottoms of the valleys and the edges raised above the plateaus, are caused by foreign matter, dust, etc., on the roll. Teats raised on the roll surface and copper slivers in the wheels are also caused by dirt.

Cylinders ground with "Intag" wheels have an appearance somewhat different from those finished with natural stones or coated abrasives in that the surface is flatter and has a less granular finish. This type of surface tends to accentuate any marks or lines. Critical examination and actual use, however, will quickly prove that the surface is remarkably free from scratches and that there is a total absence of "tint" in the high lights of the prints.

Great care should be taken to see that all wheels are free from oil and grease; in mounting wheels, the cutting surfaces should not be touched with oily hands. The wheels should be stored in a dry, clean place and never laid face down where there is dust or dirt. While it is recommended that the edges of the periphery and holes of all wheels be rounded off before using, it is absolutely necessary that this be done on the "finishing" wheels.

The fifth installment of this series of articles, to be published in May MACHINERY, will give specific directions for roll scouring and polishing, the lapping of small rolls, and the trimming of risers from roll necks, and will also review common causes of roll grinding troubles.

* * *

Annual Meeting of the Gray Iron Institute

At the annual meeting of the Gray Iron Institute held in Cleveland, March 22, a number of papers were read pertaining to both the commercial and the technical side of the foundry industry. An entire session was devoted to costs, at which four addresses were made relating to progress in cost activities and the relation of uniform costs to profits. The importance of classified molding costs was stressed.

At the technical session, the progress in developing new types of gray iron and the properties of these new gray irons were dealt with. Other subjects covered were foundry test standards, engineering aspects of gray iron structures, and the proper application of the different classes of gray iron in industry. Still another session was devoted to merchandising.

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When changes are forbidden, improvement is impossible.—*The Shop Review*

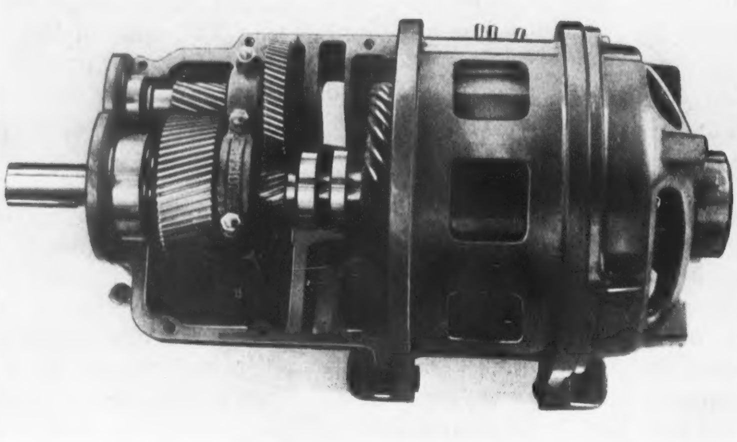

Fig. 1. Motorized Gear Reducer in which the Speed can be Changed by Substituting Another Set of Gears

Fig. 2. Any One of Four Speeds is Obtainable in this Unit without Stopping the Motor

Motorized Speed Reducers and Their Applications

Powerful, Efficient and Compact Machine Drives with Single or Variable Speeds are Obtained by Combining Motor and Reducer

By F. RICHARDZ, Westinghouse Electric & Mfg. Co., Nuttall Works, Pittsburgh, Pa.

UNTIL recently, speed reductions were obtained mainly by the use of open type gearing, belts and pulleys, or chains and sprockets. Practically all speed reducers of today are of the enclosed type; that is, all gears, chains, and sprockets are built into and covered by a housing or gear-case. The speed reduction units may be connected to the prime mover by a coupling, belt, or chain, or they may be built integral with the prime mover. The latter construction is a more recent development and is generally referred to as a motorized speed reducer.

Compact Design and Wide Speed Range Broaden the Field of Application

Motorized speed reducers are very compact and deserve the attention of every designer aiming for neatness, low cost, high efficiency, and economy in space. One type of unit, known as the "Gearmotor," is built with ratios up to 10 to 1. The speed-reducing mechanism is overhung on the motor and supported by the motor feet. This construction has been subjected to exhaustive and severe tests and has proved to be adequately strong to transmit the full motor horsepower. Above a 10 to 1 ratio, the most desirable construction is to have the motor overhung on the reduction unit. Single reduction units up to 5 to 1 and double reduction units up to 10 to 1, combined with the motor, are only a few inches longer than a standard motor. These types of reducers are particularly applicable to machine tools, conveyors, etc., where the output speed must be less than the motor speed. They can also be used as step-up units.

A Gearmotor, or motorized speed reducer, of the non-planetary double-reduction type is shown in Fig. 1 with its top cover removed. The high-speed pinion is mounted directly on the rotor shaft. This shaft is supported in the conventional manner in two bearings, one of which is in the end bracket of the motor, and the other in the reduction unit next to the high-speed pinion. The high-speed pinion is overhung and meshes with a gear mounted on an intermediate shaft which carries the low-speed pinion. This pinion meshes with the low-speed gear mounted on the output, or low-speed, shaft.

Gearmotor Can be Used with Any Type of Motor

The intermediate shaft, as well as the low-speed shaft, is supported on two anti-friction bearings. This construction makes it extremely simple to change the speed ratio, when such a change is desirable, by simply substituting another set of gears. The motor to which the reduction unit is attached is generally a standard type constant-speed induc-

tion motor, but other types of motors can be used with equally satisfactory results.

One Unit Has Four Speeds Instantly Available without Stopping the Motor

At times it is very desirable to change from one speed to another with the least amount of delay. A reduction unit of this type is available, having four different output speeds. This unit is built on somewhat similar principles to those of the Gearmotor. The gear unit, as shown by the partial assembly in Fig. 2, is directly connected to the prime mover, which, in this case, is an electric motor. The high-speed pinion, which is overhung and keyed directly to the rotor shaft, drives a gear keyed to a countershaft. The countershaft is hollow and supported on two anti-friction bearings. Between these bearings are four gears (not shown), each of which has a large concentric bore. Inside each bore is mounted a set of clutch shoes operated by driving wedges which are fitted into the countershaft. The gears on this shaft run freely on centering rings, except when one of the gears is engaged for transmitting the power from the motor. The gears on the countershaft mesh with cluster gears keyed to the output speed shaft (not shown).

When it is desired to obtain any one of the speeds, all that is necessary is to move the handle until the spring member comes into contact with the driving wedges and forces the clutch shoes against the bore of the gear. The pressure exerted by the spring member on the wedges creates adequate friction between the clutch shoes and the bore of the gear to transmit the full horsepower of the motor without slippage. The speed-changing handle is mounted directly on a pinion meshing with a rack, in which the spring member is free to turn. Any one of the four different output speeds is readily obtained while the motor is running at full load and speed by adjusting the speed-changing handle to the desired position. Only one set of gears carries the load at any speed.

This type of drive is used on machine tools, conveyors, stokers, etc., where it is desirable to change speeds rapidly. Successful and very desirable installations of this drive have been made on lathes (Fig. 3), where the cutting speeds vary with the material to be turned. One advantage of this application is that it is not necessary to stop the motor in order to stop the lathe spindle from rotating, as this can be accomplished by moving the speed-changing handle to a neutral position. "Inching," which is sometimes desirable when the cutting tool is close to a shoulder, can also be accomplished with this unit.

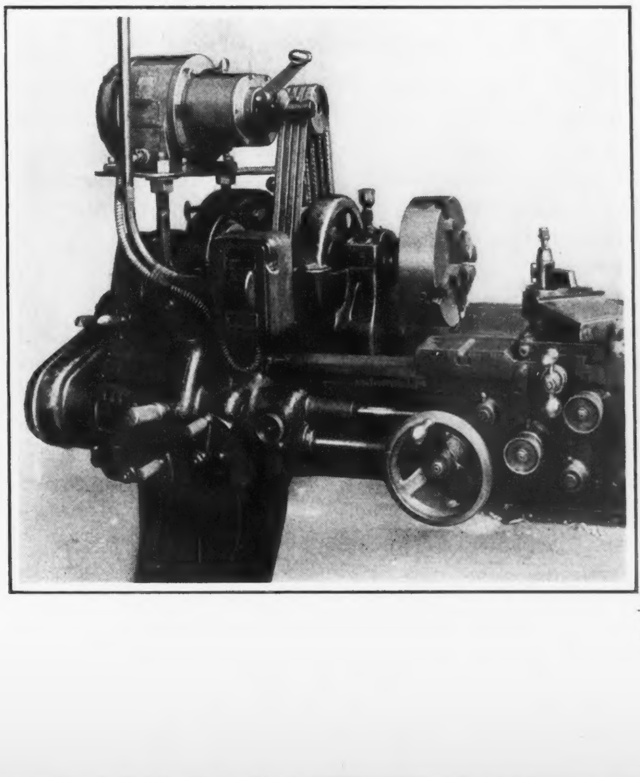

Fig. 3. The Application of a Four-speed Reduction Unit to an Engine Lathe Improves Operating Conditions

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Air Express Saves Time and Money in Shipping Machinery Parts

Air express shipments of machinery parts that move both by air and rail, as well as all-air route, are proving to be a means of saving both money and time in fulfilling installation contracts. A large machinery manufacturing company—the Robbins & Myers Co. of Springfield, Ohio—recently completed a crane and electric hoist for shipment to Jefferson, Mo. The crane was duly dispatched by freight, but the hoist could not be moved until the ball bearings had been received from the makers (the Hyatt Roller Bearing Co. of Harrison, N. J.).

The shippers were faced with the difficulty of hurriedly getting the ball bearings from New Jersey, but the eastern concern called in the Railway Express Agency air express service, and so were enabled to devote extra time to getting out the order. The shipment was forwarded from the Newark Airport at 5 P.M. on Tuesday evening and reached Cleveland at 9 P.M. Transfer was immediately made to the Cleveland, Cincinnati, Chicago and St. Louis Railway, and the routing through to Springfield was completed over a distance of 182.9 miles at 5:22 A.M. on Wednesday. Owing to the early hour, delivery could not be made until the opening of the factory at 7 A.M.

* * *

Form for Making Tool Estimates

The American Machinery and Tools Institute, 40 N. Wells St., Chicago, Ill., will send, to anyone requesting it, a copy of the estimate sheet that has been developed by the Institute as the most suitable form for making estimates in the machinery industries. On the back of the sheet are printed a number of excellent "Don'ts" for estimators.

Design and Application of Roller Friction Clutches

The Use of One of the Simplest Types of Positive Clutches Has Been Restricted Heretofore by Lack of Available Knowledge

By WARREN P. WILLETT

THIS article deals with the design and application of what is commonly called a "roller clutch." As this term is a general one, covering a variety of designs, the term "roller friction clutch" is used here to describe a type in which the rollers are in frictional contact with the clutch members, as distinguished from other types having the rollers in positive contact. The friction type roller clutch not only has the instantaneous engagement features of a friction clutch, but is also positive in action, when properly designed. For this reason it is often referred to as a positive friction clutch.

Roller clutches of the friction type consist essentially of three parts—a driving member, a driven member, and one or more rollers for engaging the driving and the driven members. These parts are shown in their relative positions in Fig. 1. Here are shown four rollers R, a clutch ring D, and a circular cam-plate B having notches to receive the rollers. When the clutch is required to operate at slow speeds only, the cam-plate can serve as the bearing on which the ring rotates, thus simplifying the design.

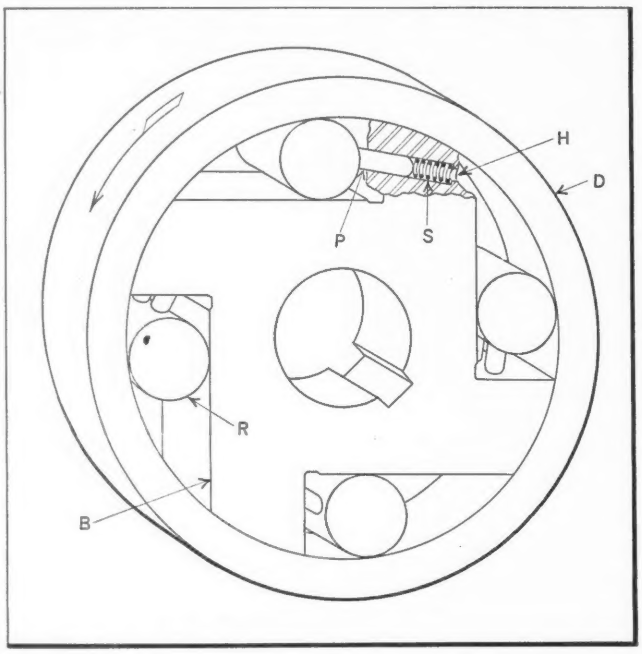


Fig. 1. Typical Arrangement of the Important Parts of a Roller Friction Clutch

The long flat faces of the cam notches and the curved surface of the inside of the ring form two converging walls between which the rollers are wedged when driving contact occurs. At the deeper end of the notch the roller has sufficient clearance to allow the ring to turn freely. The notched recesses are often made in a variety of shapes, but the form shown is one of the simplest, from a manufacturing standpoint, and none the less effective.

The plunger-pins P and the springs S, though not essential parts of the construction, are desirable, as they keep the rollers in close contact with both members and thus insure instant gripping action of every roller. Without this spring pressure, the rollers would be engaged by gravity, one at a time. This method is unsatisfactory, since the first roller falling into place is likely to be the only one to engage. In that case, the entire driving load would be concentrated on one roller instead of being distributed over all the rollers.

The clutch ring does not in most cases need to be of great thickness, as it is usually pressed into a gear or a clutch shell. The two parts thus assembled must, of course, have sufficient stiffness to prevent excessive distortion due to the pressure of the rollers. The diameter of the clutch ring is generally limited by the space available. Its inside diameter can be determined and used as a starting point from which to work out the proportions of the other parts. When four rollers are used, a ratio of 8 to 1 between the inside diameter of the ring and the diameter of the rollers gives good proportions.

The rollers must be of sufficient length to avoid stressing either the rollers or the bearing surfaces beyond the elastic limit when the pressure is exerted. Referring to Fig. 2, it will be seen that the pressure P exerted by the toggle action can be calculated by the formula for toggle linkage,

$$P = \frac{FA}{B}$$

(See MACHINERY'S HANDBOOK, page 287.) This formula gives the value of P when the force F is concentrated on a single roller, but in this case, the force is equally distributed over n rollers. To find the pressure exerted by each roller, n is inserted and the equation becomes

$$P = \frac{FA}{nB} \qquad (1)$$

Clutches, however, are very often designed to carry a given horsepower at a given speed, in which case it is convenient to put F in terms of horsepower, as shown in the following equation:

$$F = \frac{H.P. \times 63025}{NR} \qquad (2)$$

in which $H.P.$ = horsepower, N = number of revolutions per minute of clutch, and R = distance from center of rotation to center of force F, measured on line OP. Combining Equations (1) and (2),

$$P = \frac{H.P. \times 63025A}{NRBn} \qquad (3)$$

The length of roller that will safely carry this pressure can be determined by means of the Stribeck formula $w = kld$, or

$$l = \frac{w}{kd} \qquad (4)$$

in which

w = allowable load on roller, in pounds;
l = length of roller, in inches;
d = diameter of roller, in inches; and
k = a constant determined by experiment, the value of which is 1000 for hardened steel rollers on hardened steel surfaces.

The accompanying table gives the theoretical capacity of various sizes of clutches. It is based on 100 revolutions per minute and calculated by means of the formulas given. The roller length is approximately the minimum for the respective diameters.

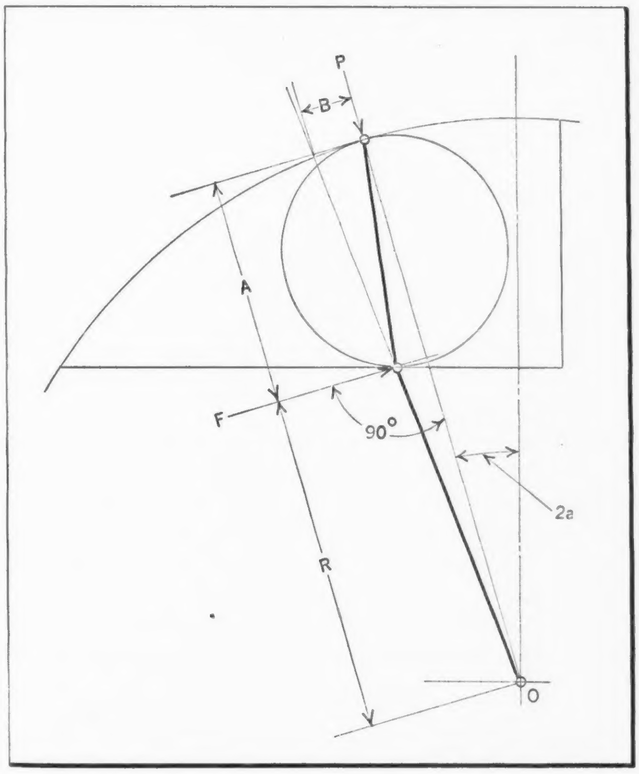


Fig. 2. Diagram Used in Determining the Crushing Pressure on the Rolls

Roller Friction-Clutch Proportions for Various Horsepowers at 100 Revolutions per Minute

Horsepower	Diameter of Ring, In.	Diameter of Roller, In.	Length of Roller, In.	Number of Rollers	Angle 2a, Degrees
1/4	4	1/2	3/4	4	7
1/2	5	5/8	15/16	4	7
1	6	3/4	1 5/32	4	7
1 1/2	7	7/8	1 5/16	4	7
2	8	1	1 1/2	4	7

As an illustration of the use of the preceding equations, the calculations required in designing a roller friction clutch will be given. The clutch is to have a capacity of 1 horsepower at 100 revolutions per minute. The inside diameter of the clutch ring is to be 6 inches. There are to be four rollers; hence the diameter will be 6 divided by 8 or 0.750 inch. The angle $2a$ is to be 7 degrees. From these known quantities the numerical values of R, B, and A can be either calculated or else scaled from an accurate, enlarged lay-out. These values were found to be as follows:

R = 2.2528 inches; B = 0.0608 inch; and A = 0.7472 inch

Substituting these values in Equation (3),

$$P = \frac{1 \times 63025 \times 0.7472}{100 \times 2.2528 \times 0.0608 \times 4} = 860 \text{ pounds}$$

The length of the roller required to carry this load can now be determined by substituting the numerical values in Equation (4):

$$l = \frac{860 \times 4}{1000 \times 3} = 1.146 \text{ inches}$$

The length of the roller is seen to be slightly more than one and one-half diameters, which is to be desired.

Precautions Necessary to Avoid Crushing of the Rollers

The roller friction clutch has been open to considerable criticism in the past because of the occasional failure of certain designs to function properly. These failures are due either to faulty design or to careless workmanship in the manufacture of the parts. The most common failures are the crushing of the metal in one or more of the engaging members, the slipping of the rollers, and the jamming of the rollers.

In order to eliminate the first fault it is necessary that the clutch be of sufficient size for the load it is to carry. By using hard materials for the engaging parts, the size of the clutch can be reduced to the minimum. Best results are obtained by using a good grade of tool steel, hardened and ground. It has been found that a scleroscope hardness of 80 to 85 gives excellent service. This hardness corresponds closely to that maintained by the manufac-

turers of roller bearings, some of whom are in a position to supply rollers that are suitable for this purpose, thus effecting considerable economy.

To keep the clutch diameter in good proportions, the rollers used should not be less than one and one-half diameters in length. Very short rollers have a tendency to become cocked in operation. It is unnecessary to use hard material for the plunger pins, but when the quantity required is small, it will be found economical to purchase stock-size bearing rollers for this purpose also. After the clutch is assembled in the housing and surrounded by oil or grease, the plunger pins are likely to have a dash-pot effect which will retard their action unless a vent is provided, such as that shown at H in Fig. 1.

The making of a hardened and ground cam-plate involves several costly operations. This cost may be greatly reduced, however, by eliminating the heat-treatment and substituting hardened and ground steel inserts at the points of engagement. Inserts are sometimes made in the form of flat rectangular blocks, dovetailed into the cam, and then doweled to prevent their working out sidewise. This method adds several expensive machining operations and the fitting of these pieces is difficult. A good inexpensive insert is made in the form of a short round plug or disk, as shown in Fig. 3. This disk is a drive fit in the cam and is ground in place on its face to a given dimension from the cam axis.

How Slipping and Jamming of Rolls are Prevented

The remaining faults mentioned—slipping and jamming of the rollers—can be analyzed together. The gripping action of the clutch is dependent upon

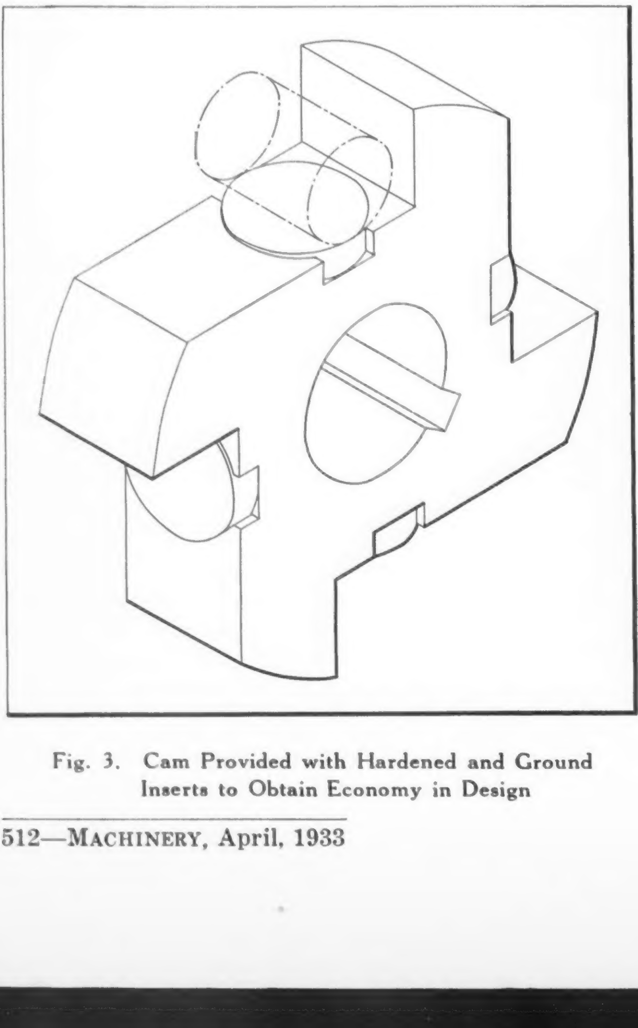


Fig. 3. Cam Provided with Hardened and Ground Inserts to Obtain Economy in Design

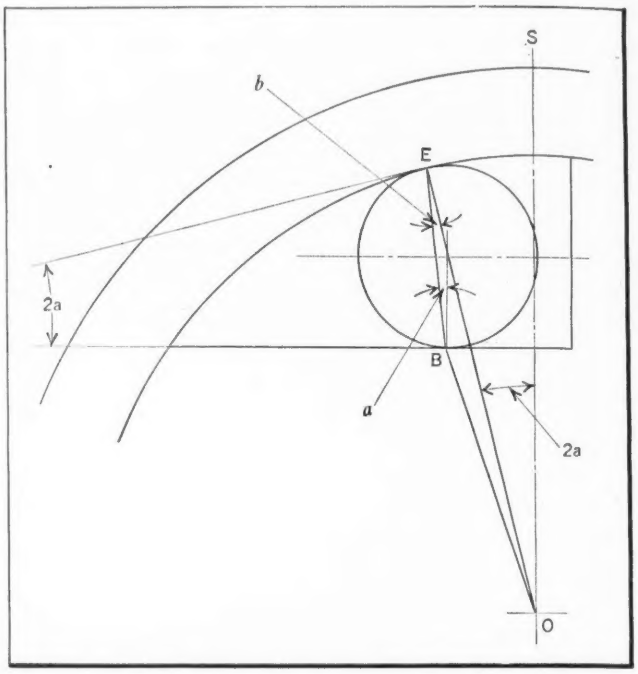


Fig. 4. Diagram Showing the Toggle Action of the Three Important Clutch Members

a toggle action, in which the roller and the cam form the links and exert pressure against the clutch ring. These imaginary links are shown diagrammatically in Fig. 4 by the lines EB and BO. The force of the toggle acts against the clutch ring along the line OE. The links are held in place by friction alone.

Friction will begin to hold at a definite angle, which is known as the angle of repose. The angle a must not exceed the angle of repose if the clutch is to hold. On the other hand, if angle a is much less than the angle of repose, the clutch will jam and be hard to release. Obviously, angle b is equal to angle a and each end of the link EB will have equal holding power.

The magnitude of angle a depends on the material, the hardness, and the condition of the engaging surfaces. For hardened and ground steel running in oil, 3 1/2 degrees gives good results. A tolerance of 1/8 degree may be allowed on either side of this. For lay-out purposes it is convenient to use the line OE to determine the correct location of the roller, as angle EOS equals $2a$.

If the correct angle is used, the clutch action will be both instantaneous and positive, yet very little effort will be required to release it. It is well to remember that jamming may be caused not only by too small a contact angle, but also by the softness of the parts.

Action and Advantages When Used as a One-Way Clutch

Of the two members B and D, in Fig. 1, either may be used as the driver and the other as the driven member. If member D is the driver but is oscillated, B will rotate when D moves in the direc-

tion of the arrow and remain stationary when D moves in the opposite direction. This arrangement is used extensively as a ratchet for intermittent feeding mechanisms such as those used for feeding sheet stock into power presses or for feeding wire into wire forming machines.

The advantage of the roller friction design when used for this type of feed is the wide range of adjustment possible. Feeds of this kind frequently require an adjustment by increments of 1/10 inch or less. This is readily obtained by varying the oscillating movement of the driving member. This fine adjustment is practically impossible with a toothed ratchet, even in cases where multiple pawls are used.

Now suppose that member B, Fig. 1, is attached to a body free to rotate and that this body has sufficient mass to maintain momentum for an appreciable time. If member B is driven by member D in the direction of the arrow and member D is suddenly stopped, or its velocity decreased, member B will continue to rotate until its momentum is spent. This principle is now being used to obtain free wheeling in automobiles. It has also been used for several years by some automobile manufacturers on the starter pinion.

With some modifications, the principle of the roller friction clutch described lends itself remarkably well to the design of an operating clutch. When used for this purpose, it is merely necessary to add another member for releasing the rollers. The Horton power press clutch, which is described in MACHINERY'S ENCYCLOPEDIA, is an example.

This principle is also used in a simplified control for the spindle feed of drilling machines. In this connection, it permits an instantaneous change from hand feed to power feed, or vice versa, and from either of these feeds to reverse. All controls are obtained by means of a single handwheel. A practical application of this kind is shown in Fig. 5.

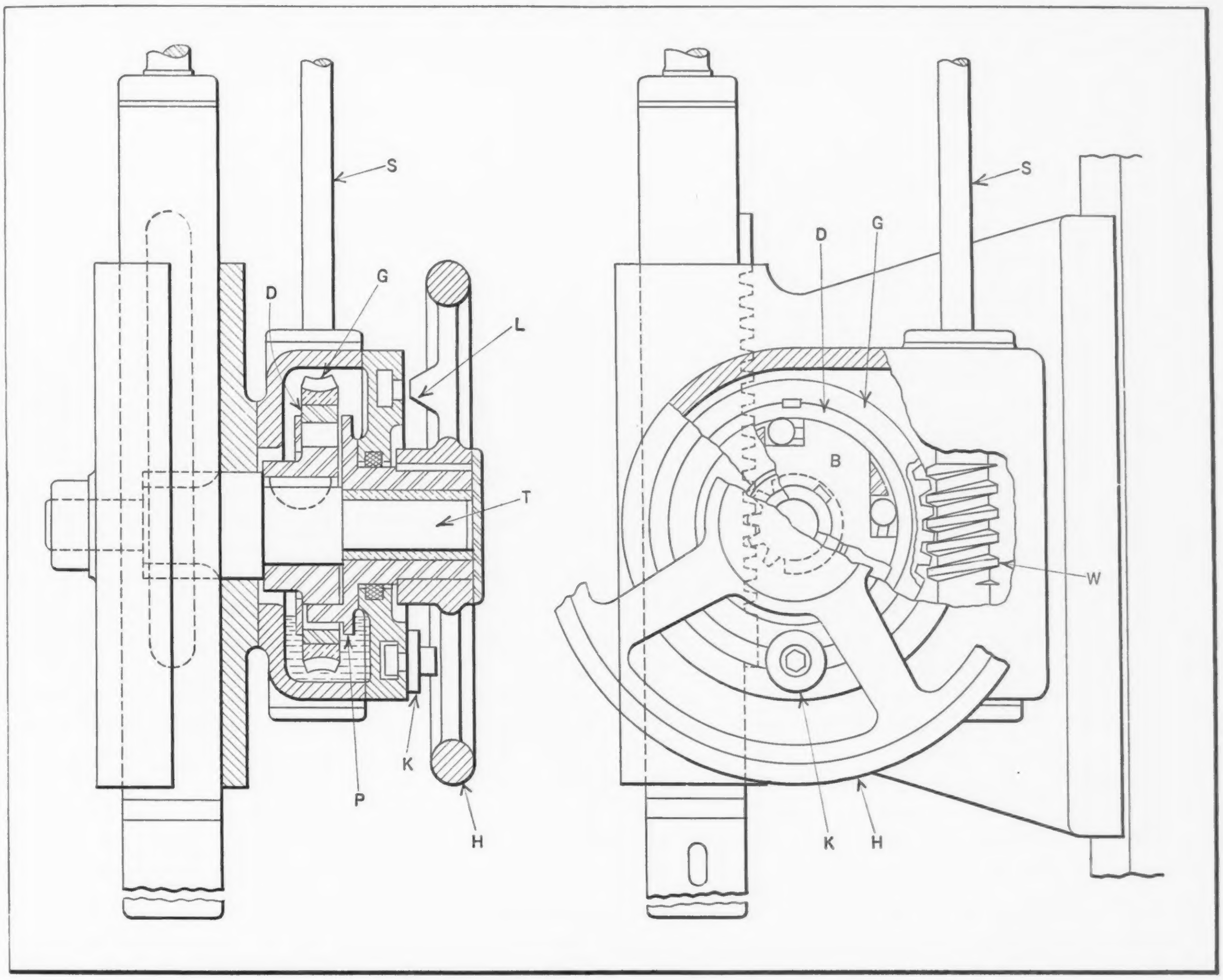


Fig. 5. Roller Clutch Incorporated in Drill Spindle Feed. Operator Controls Power and Hand Feed with a Single Handwheel

The method used to release the rollers is shown in Fig. 6. Projection C on plate P extends into the cam notches behind the rollers. Plate P is free to rotate in either direction—as far as the cam notch will permit—on the shaft T. Assume that ring D is the driving member. Now if projection C is rotated clockwise, the locking action between ring D and cam B will be broken, and as the roller is forced

back against the wall at the deeper end of the notch, the cam and the shaft T will also rotate in a clockwise direction.

If, however, projection C is rotated counterclockwise, at a speed greater than that of ring D, then the locking action will again be broken and the roller will simply roll or slide as it advances along the inner surface of the ring. From this it will be seen that if a control handle is attached to plate P, it can be used to move the driven member B back and forth, irrespective of the motion of the driving member D; but the instant the operating handle is released, the clutch will automatically engage and the power feed will become effective.

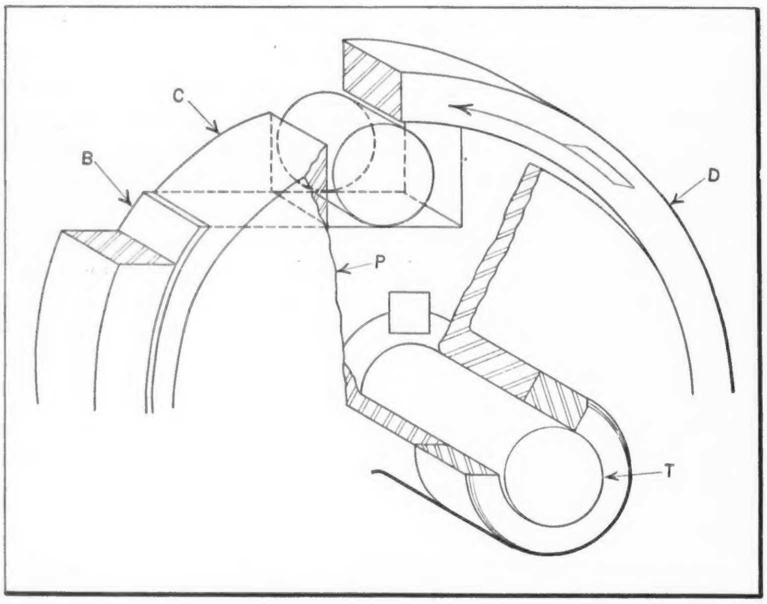


Fig. 6. Arrangement of Clutch Members in Feeding Mechanism Shown in Fig. 5

In Fig. 5 the device is shown as applied to the head of a drilling machine, where it is used to actuate the spindle quill through a rack and pinion. The cam B is keyed to the rack pinion shaft T. The plate P is provided with a long hub to which is keyed the handwheel H for manipulating the feeds. The clutch ring D is pressed into the worm-gear G which meshes with the worm W.

The worm-shaft S receives power from the spindle drive shaft of the machine. An adjustable dog K on the gear housing cover provides a means of automatically releasing the clutch at any predetermined point for accurate depth drilling. The disengagement of the clutch occurs when the lug L on the handwheel strikes the dog K.

In operating the feed, the spindle can be run down quickly, ahead of the power feed, by means of the handwheel until the drill point touches the work. Here sufficient resistance is met to check the advance of the drill until the power feed overtakes it, and the clutch will automatically engage, setting the power feed into action. After the hole is completed, the drill can be rapidly withdrawn by turning the handwheel in the reverse direction.

The features of this feed give the operator complete control through the handwheel alone and relieve his mind of all thoughts of shift levers to be thrown in or out at just the right time. When using drills of small diameter, the feeding can be done entirely by hand, but the clutch is always ready to engage the instant additional power is required. This type of feed is especially convenient in drilling through the two sides of channel shapes and forked pieces, as the drill can be fed rapidly through the gap by using the hand feed.

Once the power feed is engaged, it will, of course, continue to function until the clutch is disengaged, which is done by stopping the handwheel. Some sort of limit stop should be provided; otherwise the power feed will carry the spindle quill to the end of its stroke and stall or damage the machine. The stop-dog K can be used for this purpose if the length of the T-slot is limited; that is, when the dog is set at the end of the T-slot it will stop the handwheel just before the quill reaches the end of its stroke.

Nine Press Operations per Stroke at Ninety Strokes per Minute

How nearly 5000 threaded shells and as many washers are produced an hour simultaneously on an eyelet machine, operated in conjunction with a shell threader, will be described in an article in May MACHINERY entitled "Nine Press Operations per Stroke at Ninety Strokes per Minute." The washers are punched out from the bottom of the shell, thereby eliminating waste, and all the operations are performed by a unit set of tools. Yet these tools are simple and can be replaced quickly and at small cost when worn. The article in May MACHINERY will give an idea of the possibilities of such equipment for the production of a variety of drawn, pierced, formed, and threaded shells.

Notes and Comment on Engineering Topics

It requires 230 horsepower to send an automobile 106 miles an hour. The same speed can be obtained with 70 horsepower if the car is streamlined, according to Dr. Oskar G. Tietjens, Westinghouse research engineer. An airplane needs 140 horsepower to do 106 miles an hour, but water resistance, being many times that of air, makes a speed boat need 4000 horsepower for the same speed, according to Dr. Tietjens.

The first aluminum plant in the Soviet Union, costing about $38,000,000, was recently completed. It was erected in the open country eighty miles from Leningrad. Its annual output is expected to be 15,000 tons of aluminum. The plant occupies an area of 63 acres and is surrounded by a newly built city covering 120 acres.

The high speed of British railway trains is well known. Recently the London, Midland & Scottish Railway accelerated the schedule of its express trains between Liverpool and London. One of these trains covers the 201-mile trip in three hours and twenty minutes, being an average of a little more than 60 miles an hour, including two stops. The 152.5 miles from Crewe to Willesden is scheduled to be covered in 142 minutes, start to stop, an average of 64 miles an hour. It is believed that this is the fastest regularly scheduled start-to-stop run of over 150 miles in the world.

The first electric furnace to be put to practical use in steel-making in the United States was installed at the Halcomb Steel Works, Syracuse, N. Y., in 1906. This furnace had a capacity of four tons. In 1909, there were not over a dozen steel-making electric furnaces in use in this country. The number in 1932, however, was over 500, with capacities ranging all the way from one-half ton to one hundred tons. The cost of electrodes used for melting one ton of steel was at one time as high as $8; this has now been reduced to less than 50 cents per ton of steel melted.

A 44-foot Extension Ladder Built from Strong Aluminum Alloys and Weighing Only 172 Pounds Complete—Less than One-half the Weight of a Wooden Ladder of Similar Construction. Ladders of this Type are Convenient around Large Manufacturing Plants; the One Shown was Built by S. R. Seybold, New Kensington, Pa.

According to the *Compressed Air Magazine*, the United States Mint at Philadelphia, Pa., has found that for some dies, a thin coat of chromium plating is better than a thicker coat. On coining dies, a thin coating, not more than 0.0002 inch thick, not only increased the life of the dies to a considerable extent, but also improved the quality of the coins, whereas a heavily plated die did not give satisfactory results in stamping nickel coins.

In the Plymouth car, the use of small-diameter rollers in the universal joints makes it necessary to add lubricant only about every 20,000 miles, whereas the joints previously used required new lubricant every 2000 to 3000 miles.

EDITORIAL COMMENT

Farseeing Manufacturer Makes Modernized Plant Pay Dividends Now

Is it profitable to install new equipment to meet the limited manufacturing demand of the present time? This question is answered conclusively in the brief article "A Manufacturer Who has Faith in the Future," which will be found on page 504 of this number of MACHINERY. Ninety per cent of the equipment in this manufacturer's plant has been installed during the last three years. His faith in the future was prompted by his knowledge of the conditions in competing plants. He knew that they were filled with obsolete machinery and that they could not meet the competition of a plant with modern equipment.

Nor was the installation of new equipment altogether due to faith in the future; it was due to faith in the *present!* These are the results of this company's policy: It increased its business, measured in physical volume, in 1932 over that of 1931. It nearly doubled its share of the business offered in its particular industry. While selling prices in the industry were reduced 25 per cent, this company maintained its percentage of gross profits. After all, there must be something to this idea of replacing obsolete machines with modern equipment!

Cast Iron, It Seems, is Preparing for a Come-back

The use of welded machine bases and parts has made appreciable inroads on the use of castings; but castings, in turn, are now making unexpected inroads on the use of forgings. During recent years, remarkable developments have taken place in alloy cast-iron practice, with the result that the physical properties of such cast irons are now in many instances similar to those of steel. Hence, cast iron has taken on a new significance in the eyes of the machine designer.

Even to those familiar with what was going on in the alloy cast-iron field, it was somewhat of a surprise to learn that alloy cast iron had been adopted by a well-known automobile manufacturer for so highly stressed an automobile part as the camshaft; and experiments with cast-iron crankshafts have apparently given satisfactory results—so much so that cast crankshafts are hardly experiments any longer.

Obviously, the possibilities of alloy cast iron merit the closest attention on the part of designers of machinery of all types. It may even be that cast gears may once more come into favor; the grinding of the tooth faces would assure an accuracy equal to that of cut gears.

The extent to which alloy cast-iron parts will replace forged steel is, of course, still a matter for speculation, but there is no doubt that the product of the foundry will regain some of the prestige that it lost through the rapid advance in welding practice.

It is Possible to Accept New Ideas Too Readily

A philosopher of the past said that all virtues become vices if carried to excess. The general idea expressed in this thought is frequently seen at work in industry. Accuracy is a commendable thing, but it can be carried to excess. Applying extreme accuracy to work that does not require it is simply waste.

When scientific management principles were first introduced, many carried the new ideas to excess. Where conditions required merely an orderly procedure, rigid systems were adopted instead, and the systems frequently degenerated into red tape. What was intended to be a common-sense, economical method of management became a wasteful tangle of forms and reports.

Inventory control is a commendable thing, but inventories can be shaved so close that dollars may be wasted by production being held up in order to save cents in the turnover of materials.

The new carbide cutting tools present remarkable possibilities, but if an attempt is made to apply them to all kinds of work, the experiment may not prove successful. There are purposes for which these cutting materials are eminently suitable; but there are also uses for which the older cutting tools are more economical. Judgment must be applied to each problem.

There is a certain type of mind that is inclined to grasp at every new idea as if it were a panacea for all troubles. Such minds do more to discredit than to help along the application of new developments. Many so-called "efficiency engineers" in the early days of scientific management were the cause of the distrust with which conservative men looked upon the new methods. After all, common sense and deliberate judgment are two qualities of mind that are most essential in successful industrial management and plant operation.

Ingenious Mechanical Movements

Mechanisms Selected by Experienced Machine Designers as Typical Examples Applicable in the Construction of Automatic Machines and Other Devices

Single Cam Action Performs Four Different Functions

By VINCENT WAITKUS

An excellent example of a multiple cam action in which four movements are obtained essentially by one simple edge-cam is shown in Fig. 1. It is applied to a device used for capping bottles, and although two cams are used here, they are identical and impart the same movements simultaneously. The cam arrangement is such that by swinging the forked lever *G* toward the right, a split collar or "table" grips the neck of the bottle, the table being automatically locked in this position while continued movement of the lever causes the cap to be forced in place. To remove the device from the bottle after the capping operation, the lever is merely returned to its original position.

One of the outstanding features in the design of this device is that only one screw is required in its assembly. No machining is done on any of the parts, as sufficient clearance has been allowed to permit the use of unfinished castings. This arrangement resulted in an inexpensive product which in no way affects its utility. The body *A* is cast in two parts, which are held together by the interlocking hooks at *B* and the screw *C*. The cup-shaped capping hood *D* is held in place between the two halves of the body and prevented from rotating by the two lugs *E*. Inside the capping hood is a rubber pad *F* which is forced into place and held by a stem projecting through a hole in both the hood and the body.

The forked capping lever *G* has two pins *H* cast

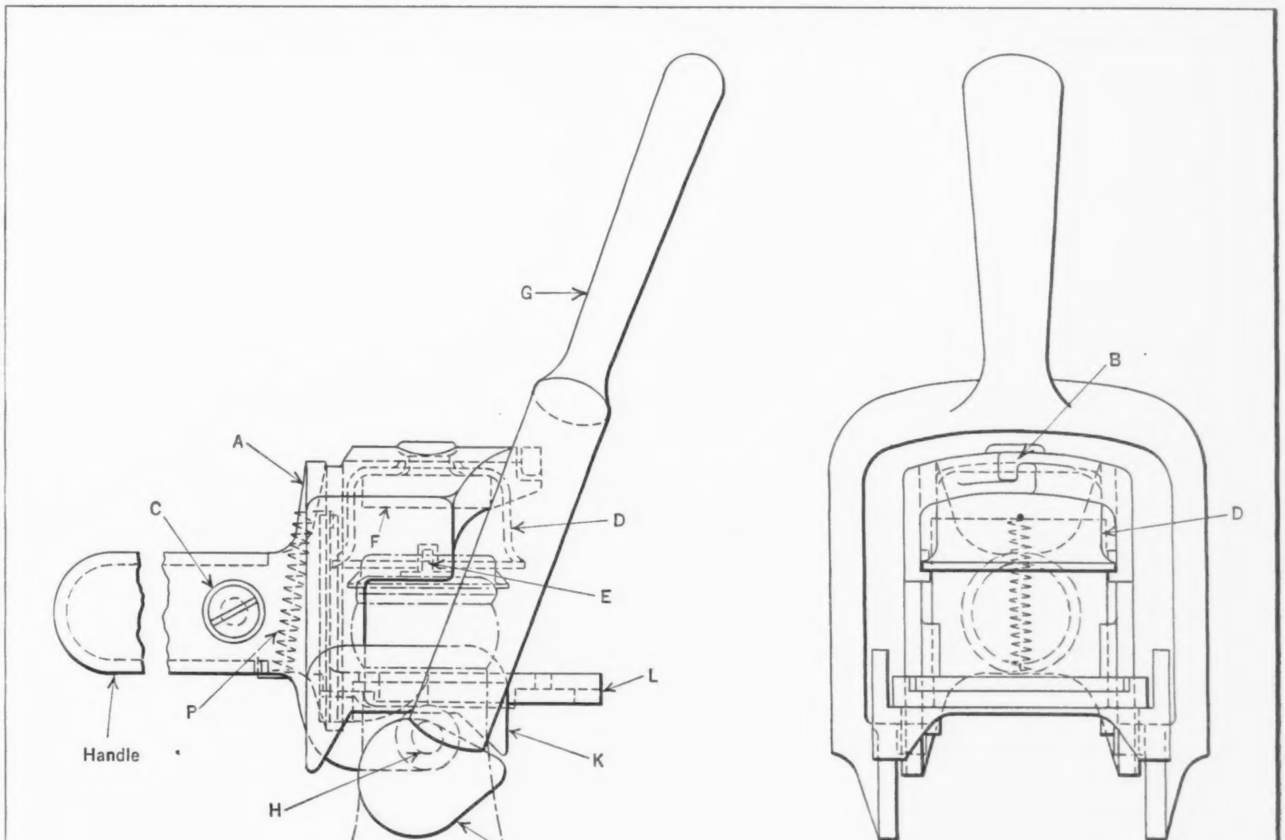


Fig. 1. Arrangement in which Only One Cam-lever is Required for the Operation of a Bottle-capping Device

integral with it. These pins serve as a pivot for the lever and engage holes in the lower part of the body. On each side of the forked lever is a cam *J*. The most important part of the device is the split collar or table which consists of two parts—the lifting cam-plate *K* and the guide plate *L*, the latter having a sliding fit in the body. Both parts of this table are interlocked, as shown in Fig. 2.

The cams *J* on the capping lever impart four different movements. When lever *G* is in its farthest position toward the left, the table halves are separated in order to permit the open end of the bottle to pass through. Separation of the table halves, as indicated in both sectional views in Fig. 2, is accomplished as the point of the cam engages the projection *M* on the cam-plate. Referring to the extreme left-hand view, it will be noted that the table halves are together, in position to grip the neck of the bottle. This is done with the portion *R* of the cam as it engages the projection *N* on the cam-plate when lever *G* is swung toward the right. Continuation of this lever movement (see extreme right-hand view) causes the cam to rotate into a position where it has forced the cap down over the bottle top, thus completing the operation.

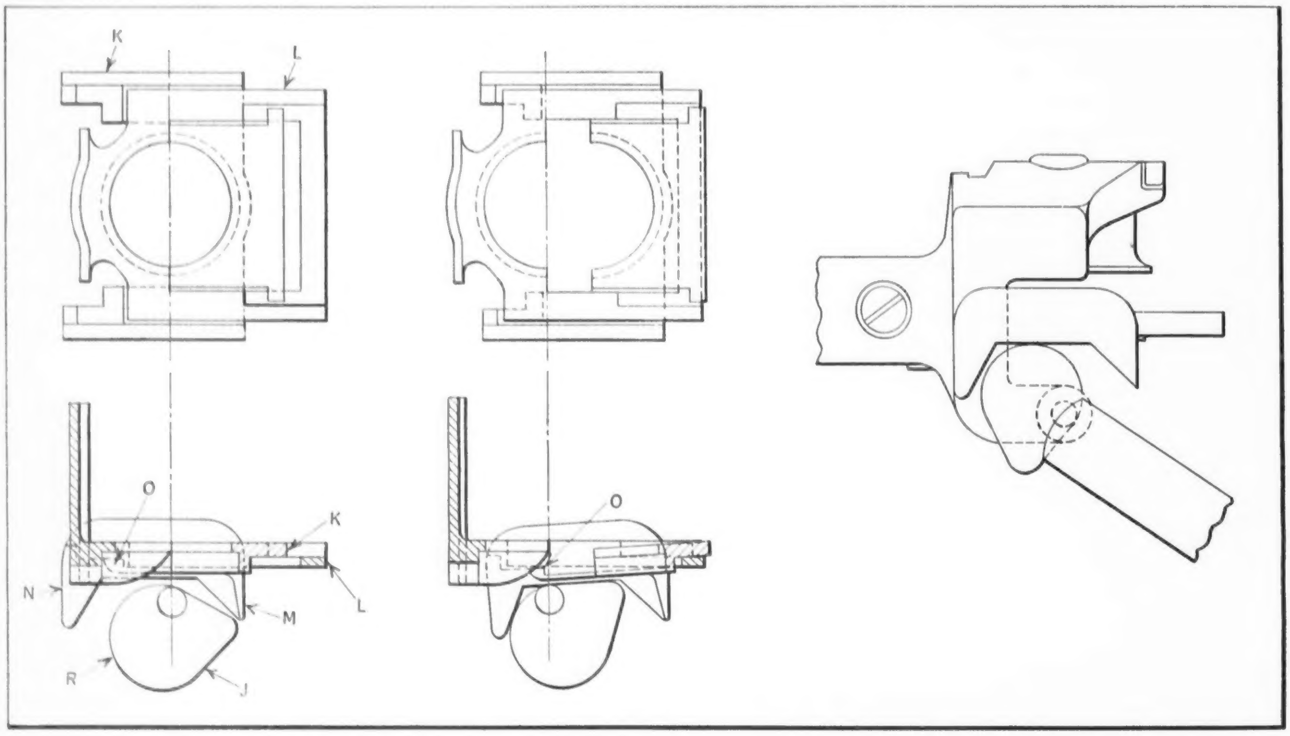


Fig. 2. Views Showing the Closing, Locking, Capping, and Opening Actions Obtained by the Twin Cams

During the capping operation, there is a side thrust on the cam-plate *K* which tends to separate the halves of the table. This would, of course, permit the bottle neck to pass through the table. To prevent this, latches *O* are provided on the cam-plate. These latches hook over the end of the guide plate and lock the two halves after they have been closed around the neck of the bottle.

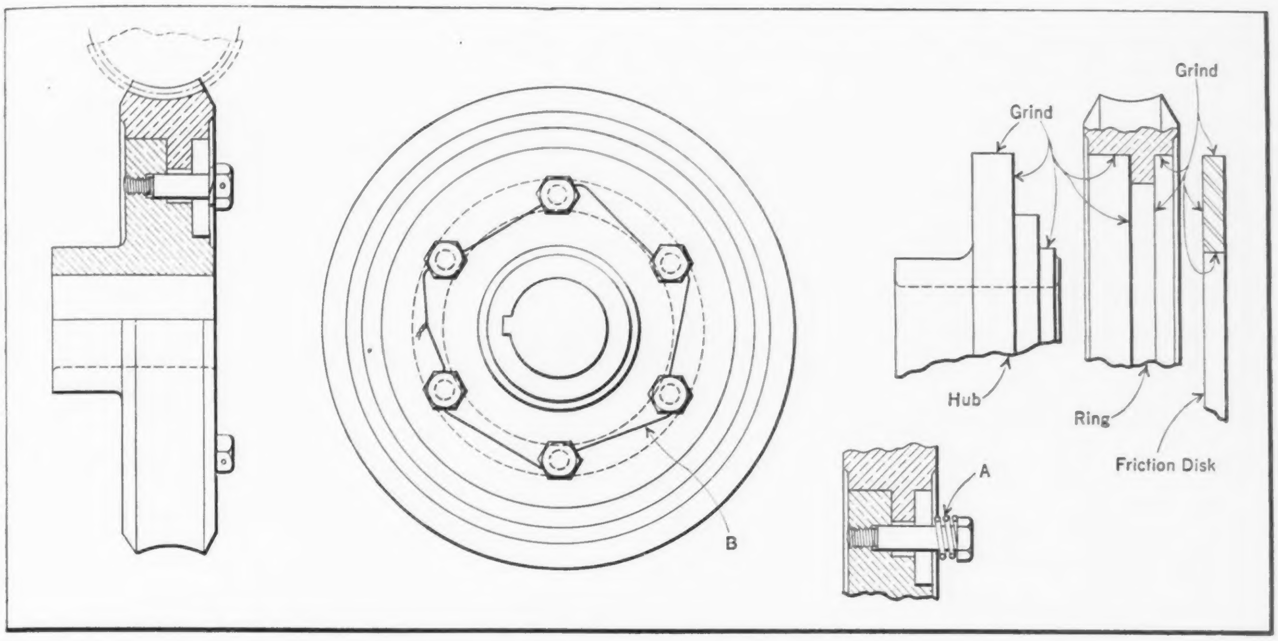
When the lever *G* is swung toward the left to open the table halves, the cams on this lever tilt the cam-plate *K* enough to disengage the latch and permit it to pass under the guide plate *L*. This is shown clearly in the central view. A spring *P*, Fig. 1, keeps the cam in contact with the cam-plate. One end of this spring is fastened to the body and the other end to the guide plate.

Friction Gear Drive that Prevents Overload

By FRANK W. CURTIS

A friction release for large drive gears, arranged so that an overload would cause slippage, was described in October MACHINERY, page 123. A similar principle, applicable to smaller gears, is incorporated in the worm-gear shown in the accompanying illustration. This gear was designed for use in a wrapping machine in which failure of any part to function would merely result in slippage of the drive gear. The same principle, however, has many applications in special and automatic machinery.

Instead of making the gear from one piece, it is constructed from three pieces, namely, a hub, a ring on which the teeth are cut, and a friction disk. These are assembled, as shown at the left, by six bolts. Originally helical springs were placed between the disk and the bolt heads, as shown at *A*, but in this particular application, it was found that spring lock-washers were satisfactory if the studs were not screwed up too tight. The use of helical springs, however, is recommended when slippage



Worm-gear with Friction Clutch that Prevents Overloading the Driving or Driven Units

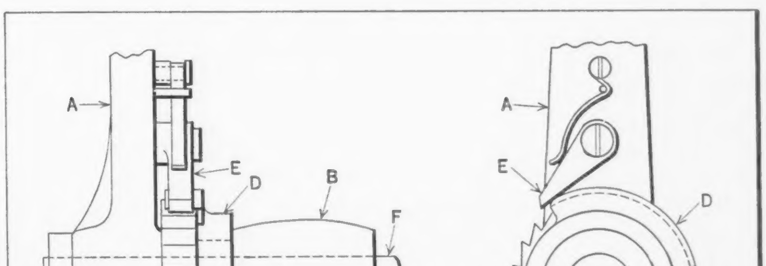
must occur at an accurately specified stress. After the proper adjustment has been made, the bolts are restrained from turning by the wire *B* which passes through holes in the heads of the bolts. To insure concentricity, it is best to grind the surfaces as indicated at the right, allowing just enough clearance to offer a free-running fit. These units are then assembled, after which the teeth are cut just the same as in any regular gear.

Before adopting this design, the gear was tested by means of a prony-brake mechanism, comprising a pinion drive, a brake-shoe, and an arm that worked in conjunction with an ordinary weight scale. The precision with which the drive could be made to release was quite surprising. A prony-brake mechanism is recommended for adjusting units for a given load that must be maintained closely. The hub and gear ring of the worm-gear are made of bronze, and the friction disk is made of steel.

Simple Arrangement for Varying a Ratchet Movement

Alterations made in a certain product necessitated shortening a ratchet movement on the production machine. The new ratchet arrangement is shown in the illustration. Oscillating lever *A* is actuated by a cam (not shown) and carries the pawl *E*, which through the ratchet wheel *C*, transmits the required intermittent movement to shaft *F*. Adjustment of the angular movement of this shaft is obtained by means of the shield *D*.

Bearing *B* was turned down on one end to serve as a support for the shield, which is held in a stationary position by a set-screw. Near the end of the back stroke of the lever, the shield lifts the pawl away from the ratchet wheel. Thus, part of the subsequent forward stroke of the lever is completed before the shield permits the pawl to engage the ratchet wheel, so that the angular movement of the shaft is shortened. By varying the position of the shield, the angular movement of the shaft will also be varied. R. H. K.



Application of a Shield to a Ratchet for Reducing the Angular Movement Transmitted

* * *

Five years ago, it would have been considered utter folly to suggest the use of cast iron for the camshaft of a high-speed automotive engine. The fact that alloy cast-iron camshafts are in production today is a high tribute to current progress in cast-iron metallurgy.—*T. H. Wickenden of the International Nickel Co., Inc.*

Fabricating Products by Electric Furnace Brazing

Brazing in Controlled Atmosphere Produces Strong Joints on Small Assemblies and Keeps Parts Clean and Bright

By H. M. WEBBER, Industrial Department
General Electric Co., Schenectady, N. Y.

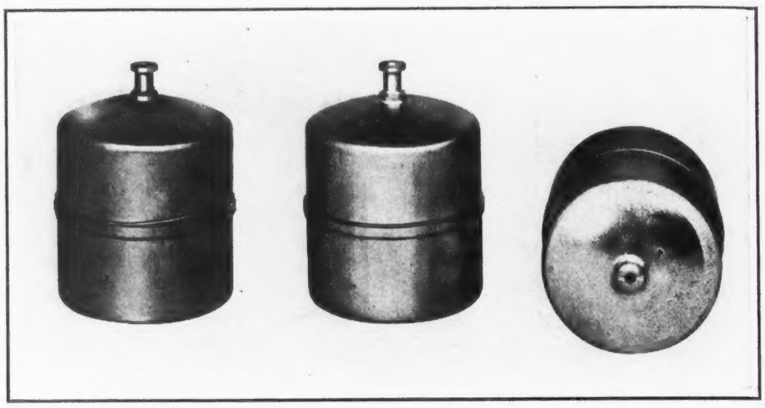


Fig. 1. Steel Float Made of Five Inexpensive Parts which are Copper Brazed in an Electric Furnace. View at Left Shows Part Ready for Brazing, and Two Views at Right Show Floats after Brazing

THE fabrication of metal shapes by the process of electric furnace brazing has been developed by the General Electric Co. to a high degree of perfection in the production of electric refrigerators. This method of brazing consists of passing assembled parts through a controlled-atmosphere electric furnace, copper being applied near all the joints of the parts, so that when it melts in the reducing atmosphere it will run into the joints and form strong, tight bonds when cool. The reducing atmosphere takes the place of the flux used in other brazing methods and has the advantage of keeping the parts clean and free from oxidation, making further cleaning unnecessary after brazing.

It is the purpose of this article to discuss the design, manufacture, and assembly of parts made by this method of brazing in such a manner as to bring out some of the advantages and limitations of the process, and point the way to other applications.

Brazing Multiple Joints of Steel Parts in One Operation

Multiple-joint parts of suitable design, made of steel, are particularly well adapted to electric furnace brazing, because the seams can all be joined in one passage through the furnace. Copper can be applied to the joints in the form of wire, chips, or paste. The paste is made up of a mixture of copper dust, pyroxylin, and thinner, and can be daubed on the parts adjacent to joints where it would be difficult to place a copper wire or chips. Sometimes even the electroplating process is used to furnish or augment the supply of copper at the joints.

When the molten copper flows into the joints, a small amount of iron goes into solution with it, forming an alloy bond stronger than copper itself. For instance, some laboratory test bars composed of 97 per cent copper and 3 per cent iron broke, in the annealed condition, at 48,000 pounds per square inch, while pure copper annealed bars, made and tested at the same time, had an ultimate strength of about 32,000 pounds per square inch. This shows an increase of 50 per cent in the strength due to the addition of iron.

Advantages of Electric Furnace Brazed Construction

There are several good reasons for the electric furnace brazing of some of the parts of electric refrigerators. The first is economy, but other advantages are strength, gas-tightness, and cleanliness. Fig. 1 shows an electric furnace brazed steel float used in a refrigerator. The substitution of steel for a non-ferrous material represents one saving, and the brazing of five joints all at one time is a decided factor in the choice of the electric furnace method. Also, the elimination of the human factor results in a negligible number of rejects because of leaks.

A cross-section of the electric furnace brazed steel float illustrated in Fig. 1 is shown in Fig. 2. Two drawn shells are pressed together with a sleeve fit over a piece of seamless steel tubing, as illustrated. A copper wire ring is dropped over the tube during assembly and lies in the bottom of the float adjacent to the joint between the tube and the shell. There is also a steel bushing pressed into each end of the tube after the shells are assembled, making five joints in all.

A copper wire is wrapped and twisted around the upper shell next to the joint in the mid-section, and

a small ring is dropped over the bushing that projects over the top. Copper being thus supplied to all the joints, the part is ready to be brazed. A passage through the electric brazing furnace brings the floats out uniformly clean, strong, and tight. The surface actually takes on a silvery appearance, both inside and outside, from the effect of the reducing atmosphere.

The shells are formed from deep-drawing steel in one draw. A hole is punched and drawn in each shell to accommodate the tube. Before going to the assembly line, the shells are passed through an alkaline wash to remove the drawing compound. The tube is seamless steel, and is pickled and sized at each end before assembly. The bushings are screw machine parts, and they, too, are washed. All joints are a press fit. The floats are assembled in machines by girls in a production line, each girl performing a single operation.

A small vent-hole is left in one of the shells of the float during the brazing operation to allow the expanding gases to escape. Otherwise a float occasionally would be forced part way open and be brazed solidly in this position. The vent-hole is plugged with a brass tack and soft-soldered after brazing. This piece is a good example of the kind of product that can be made at low cost by the electric furnace brazing process.

The diameter of the copper wire used in brazing a joint is determined by trial. The wire must be large enough to insure a plentiful supply of copper to the joint without forming an excess that will solidify in copper drops that must be ground off. Any good commercial grade of copper is suitable for the job. One way of making the rings is to cut through a helix of annealed copper wire wound on a mandrel in a lathe. The mandrel diameter can be chosen to give rings of the right size.

Methods Used in Producing Float Chambers

The float chamber shown at *D*, Fig. 4, is another part that is well adapted to be produced by the electric furnace brazing process. This chamber is the receptacle for the float shown in Fig. 2. It is made of a drawn shell, two screw machine parts, and a short piece of tubing, all brazed together in one passage through the furnace.

The shell is formed from deep-drawing steel in three draws, there being a wash and a bright annealing operation between the first and second draws. After the last draw, the shell is washed and trimmed, and two holes are pierced and flattened in the end. The center bushing, a screw machine part, is forced and held tightly in a hole by peening, as shown in the lower view, Fig. 3. This

Fig. 2. Cross-section of Steel Float, Assembled with Copper Wire Rings which Melt and Flow into All Joints when Work Passes through Electric Furnace

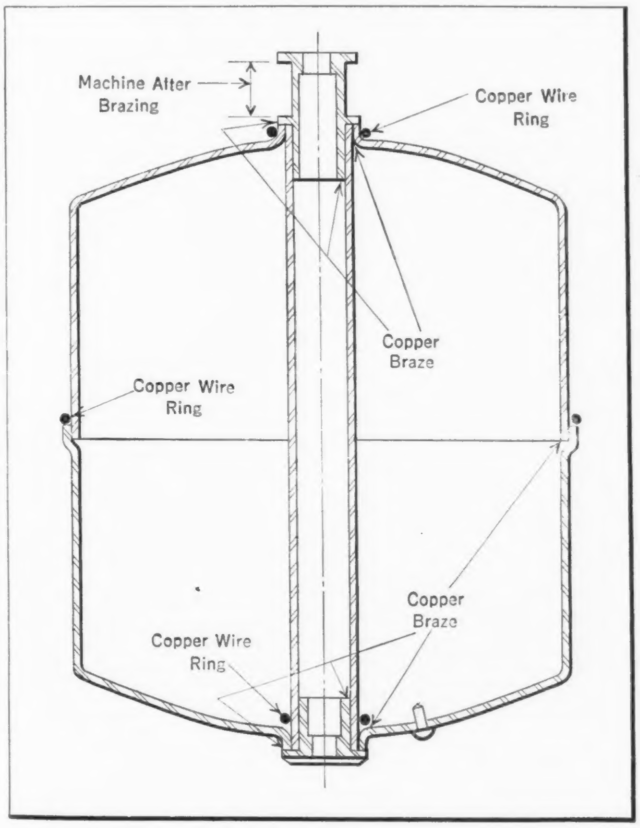
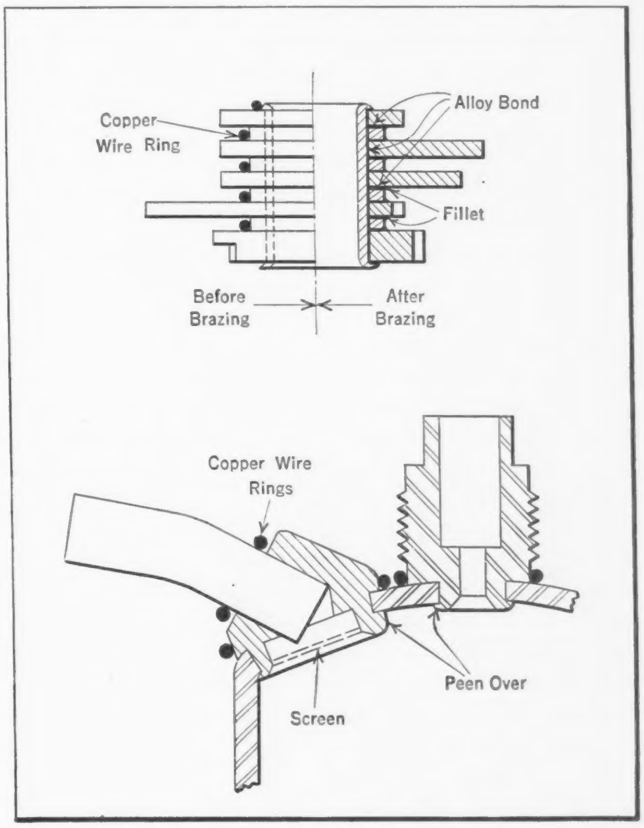


Fig. 3. (Upper View) Details of Brazed Cam Cluster Assembly Shown at B, Fig. 4. (Lower View) Assembly Details of Float Chamber Shown at D, Fig. 4



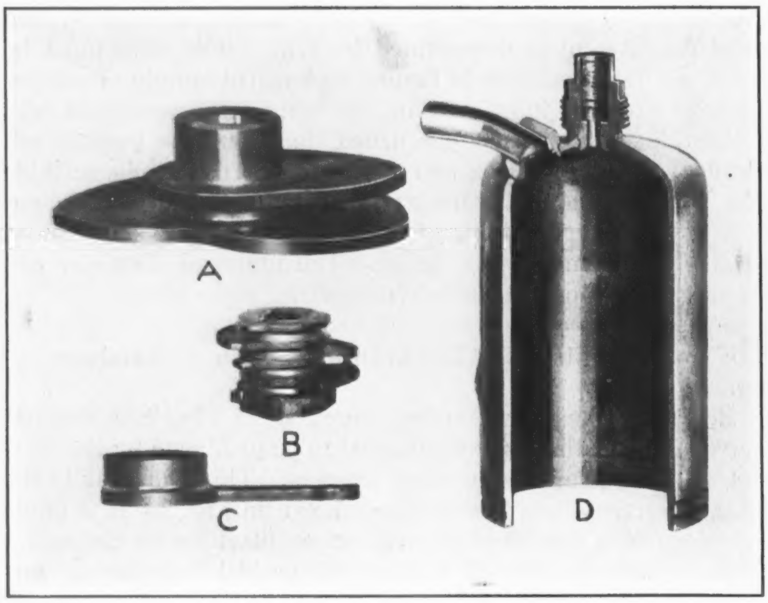


Fig. 4. (A) and (B) Copper-brazed Cam-cluster Assemblies; (C) Hub and Lever of Brazed Construction; (D) Float Chamber with Section Cut Away to Show Brazed Joints

is a cheaper method of getting a good fit than trying to maintain close tolerances on the bushing and hole, and the important factor is that an exceptionally tight, strong joint is insured.

The other bushing, which has had a fine-mesh steel screen rolled into its lower part and a short seamless-steel tube pressed into its hole, is assembled in a like manner. The center bushing carries a copper ring in its assembly. Two copper wire rings are dropped over the other parts, as shown in Fig. 3. The copper melts and flows through the joints while in the brazing furnace, but precautions are taken to keep it from plugging the mesh of the screen by giving the screen a flash of chrome-plating before assembly. The molten copper does not wet and run on chromium.

Procedure in Fabricating Refrigerator Check-Valve

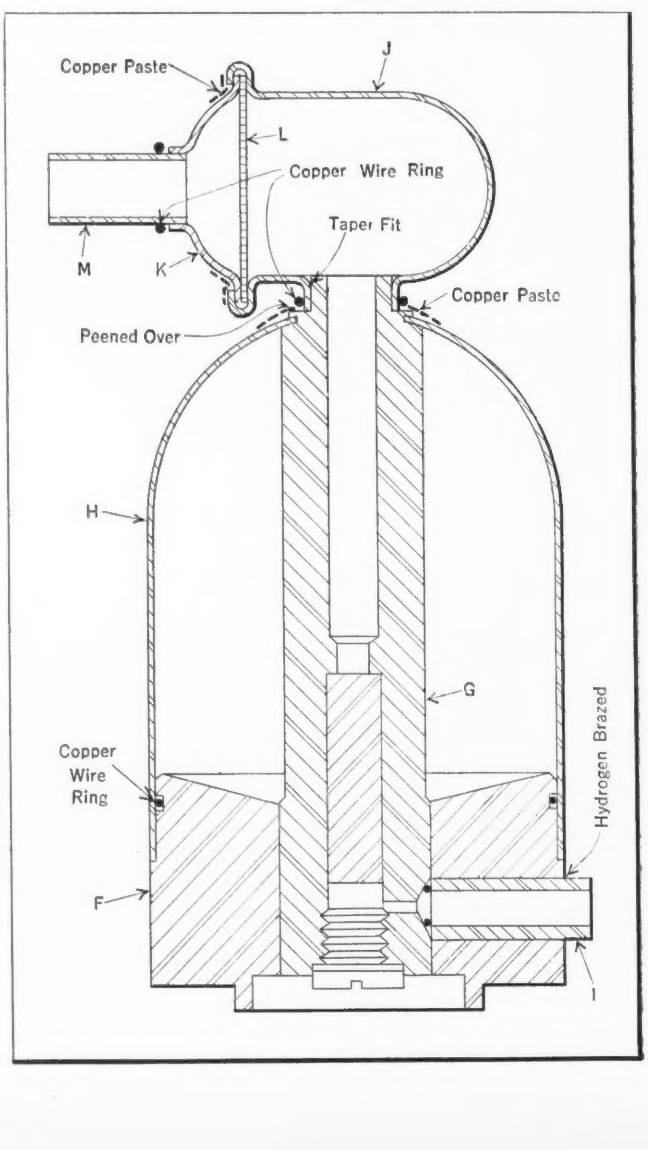
The refrigerator check-valve shown in Fig. 5 is designed specifically for the electric furnace brazing process. It illustrates the ease with which a number of inexpensive drawn parts can be assembled and brazed to form an otherwise complicated device. There are eight parts in all, solidly bonded together to form the complete check-valve.

First two screw machine parts, the base *F* and the stem *G*, are made of free-cutting steel. These parts act as a foundation for the other parts. An interesting feature is the groove around the outer edge of the top of the base into which is snapped a copper wire ring—a positive way of applying copper, since after the outer shell is pressed on the base, as shown in the section view, the wire is actually within the joint and cannot be jarred out of place in being handled. Also, when the copper appears uniformly around the outside of a joint, one has a visual indication that a good braze has been made if the joint was tight in the beginning.

The stem *G* is pressed into a reamed hole in the base *F*, as shown. The lower end of the stem is centerless-ground to a force fit. At the top of the stem is a double shoulder, the larger diameter fitting into a punched hole in the top of the large shell *H* which extends down over the base. After this shell is pressed over the base, the shoulder of the stem is swaged or peened down over the edge of the hole to insure a tight joint. With this arrangement, it is not necessary to hold close tolerances on the stem and the hole.

Next a small steel tube *I*, centerless-ground to a force fit, is pressed into a reamed hole in the base. Deep inside the

Fig. 5. Cross-section of Refrigerator Check-valve, Consisting of Eight Parts Assembled with Press Fits and with Copper Rings and Paste in Place Ready for Brazing



hole, at the end of the tube, is a copper wire ring, dropped in place during assembly to melt and make a gas-tight joint around the tube. The copper brazes the stem to the base and the tube to its hole.

The hood-shaped assembly of two drawn parts *J* and *K*, a chromium-plated screen *L*, a tube *M*, and a copper ring around the lip of the small hole in the larger of the two drawn pieces is then pressed over the tapered end of stem *G*. The taper permits the use of wide tolerances and at the same time insures a tight joint.

The hood assembly is made up in several operations. The piece *K* is drawn and punched, and a lip is pushed out around the hole. Into this hole is pressed the short piece of seamless-steel tubing *M*, which is given a sizing operation in the end at the joint during the assembly to insure a tight fit. The other shell *J* is first cupped, then washed, bright-annealed, drawn to final shape with a shoulder around the rim, sheared, and punched. The lip is then pushed out around the punched hole and the part is again washed.

The hood is next put together by pressing the screen and the cupped-disk assembly into the shell and rolling the rim of the shell over them, giving a firm tight joint. This rolled-type joint is used frequently for the electric furnace brazing process. A copper ring is pressed over the tube, another ring is pressed over the lip of the hole in the shell, and the piece is ready for final assembly, during which this part is pressed on top of the shell-stem-base assembly.

The finishing touch is the daubing of a small amount of copper paste around the two rolled edges. Copper is thus applied at six joints in the form of wire or paste, and all these joints become tightly brazed in a single passage through the electric furnace with controlled atmosphere. As the check-valves come from the furnace, they are clean, tight, and free from scale.

Applications in the Machine-Building Field

The electric furnace brazing process is being used for tipping tools with tungsten-carbide inserts and for assembling the parts of atomic-hydrogen welding torches and automatic welding heads, because of the economy and strength attained. Thermostat frames, double-wall steel tubing, golf-club shafts, and spiral fin steel tubing are a few other interesting applications.

Assemblies of a number of small machine parts frequently lend themselves particularly well to fabrication by the electric furnace brazing process. For instance, some machines contain a large number of small gear and cam clusters, the design of which can be readily adapted to such brazing by changing minor details. Parts *A*, *B*, and *C*, Fig. 4, belong to this class.

Part *B*, Fig. 4, consists of a series of small cams and spacers solidly brazed on a common tubular shaft. Ordinarily, it would be necessary to index the cams, stake them, drill two or three holes through the entire assembly, and then rivet the parts together. If brazed by the electric furnace process, the operations can be simplified by dropping a copper wire ring around each spacer as the cams and spacers are pressed over the shaft, and then indexing, staking, loading on trays, and passing the assembled units through the furnace.

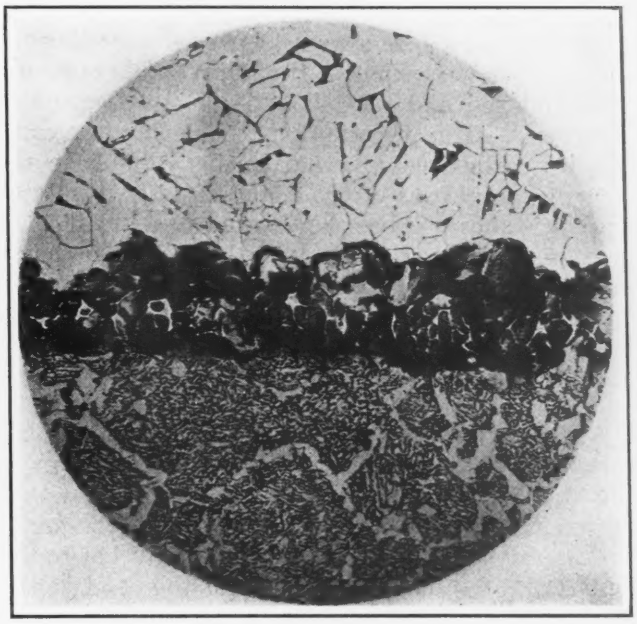


Fig. 6. Photomicrograph of Electric Furnace Brazed Joint, Showing Tendency toward Grain Growth across Joint. The Copper Penetrates the Steel along the Grain Boundaries and Goes into Solution with the Steel at the Surface, Contributing to the Strength of the Brazed Joint

Since a large number of such pieces can be brazed at one time on a tray, the unit brazing cost is low. With this method, there is no chance for the cams to work loose when they are once brazed. The upper view, Fig. 3, shows the assembly of small cams in section, staked, and with wires in place, ready for electric furnace brazing, and the same part after brazing. Note the fillet beneath each cam—a sure indication that the copper from the wire above the cam has melted and flowed through the joint by the aid of capillary attraction, a slight excess of copper being puddled where it came out of the joint, leaving the fillet.

In addition to each cam being solidly fastened to the shaft in this instance, it is also firmly brazed to the spacer on each side. The shaft is a desirable part, because it allows the cams and spacers to be assembled over it with a press fit that holds the assembly rigid during the brazing process. Results from the electric furnace brazing process improve with the tightness of the joints, there being no necessity of leaving space for the copper. Molten copper flows through the tiniest crevices, and press-fit joints are used whenever possible.

The brazed assembly of cams shown at *A*, Fig. 4, has the bushing designed with a shoulder, and the

two cams and a spacer pressed over the smaller end with copper wire rings at the joints. The cams are then indexed and staked, and the preparation is complete. After electric furnace brazing, the cams can be carburized and hardened to improve the wearing properties of the edges, if desired. At *C*, Fig. 4, is shown a bushing brazed to a small lever arm. Such brazed pieces lend themselves to large-scale production where many such parts go to make up one machine.

Factors that Insure Strong Joints

A photomicrograph of the section of an electric furnace brazed joint in one of the parts shown in Fig. 4 is shown in Fig. 6. It will be noticed that the grains of the steel tend to grow across the joint; also the copper alloys with the steel adjacent to the joint (note the darkened grains of the steel at the joint) and penetrates along the grain boundaries of the steel. All these features, coupled with the fact that a small amount of iron goes into solution with the copper in the joint, contribute to the formation of a bond of alloy that is much stronger than copper and that will withstand much harder usage than these parts will ever receive.

Some of the designs of joints for which the electric furnace brazing process is best adapted have been shown in the accompanying illustrations. They include joints machined and ground to a press fit, tapered joints, rolled joints, and peened and swaged joints. In every case, the metals are brought as tightly together as possible to assist the capillary attraction which improves the flow of copper. Care is also taken to keep the metal surfaces clean, so that the copper can easily wet the steel and thereby flow on the surfaces. The parts are assembled rigidly, so they will not come apart in being moved from the heating chamber to the cooling chamber while the copper is molten.

The Second Soviet Five-Year Plan

The first stage of the second five-year plan of Soviet Russia has just been inaugurated. While performance in many directions has fallen short of the first five-year plan, nevertheless the general progress that has been made in engineering in the Soviet Union during the last five years has been so remarkable that attention should be given to the second five-year plan. The brief review that follows will give an idea of the directions in which particular efforts will be exerted during the coming years.

The plan calls for an average increase of somewhat more than 16 per cent in industrial production in 1933 over that scheduled for 1932. Using round figures, the output of raw materials in 1933 is planned as follows: Coal, 84,000,000 tons; oil, 24,000,000 tons; pig iron, 9,000,000 tons; steel, 9,000,000 tons; rolled metals, 6,250,000 tons, including nearly 900,000 tons of high-grade steels. In the machinery field, the plans call for 60,000 tractors, 40,000 other motor vehicles, 1175 locomotives, and 34,000 freight cars during the year.

Among the plants that are to be put into operation during the present year may be mentioned fifteen blast furnaces, with an annual output of 3,700,000 tons; forty-five Martin furnaces, with an annual output of 3,000,000 tons; fifteen electric furnaces; four blooming mills; fifteen rolling mills; and four tube-rolling mills.

Considerable progress in the machine tool building industry is planned. The newly opened works are expected to produce a total of 18,000 machine tools during 1933. The works at Moscow and Nizhni Novgorod build milling machines and turret lathes, respectively, while the Sverdlov Works at Leningrad build planers.

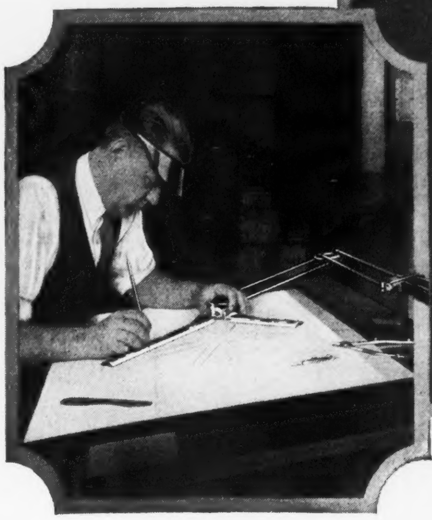
While, obviously, great effort is being made to hasten the time when the Soviet Union will be self-supporting in the matter of machine tools, it is evident that the requirements from outside sources will still be very large this year. In 1932, the largest proportion of these orders went to German and British firms; the large share of this business that was held by manufacturers in the United States in 1930 was materially reduced. It is to be hoped that steps will be taken in the near future by the Administration to further the development of our machinery trade with the Soviet Republic.

* * *

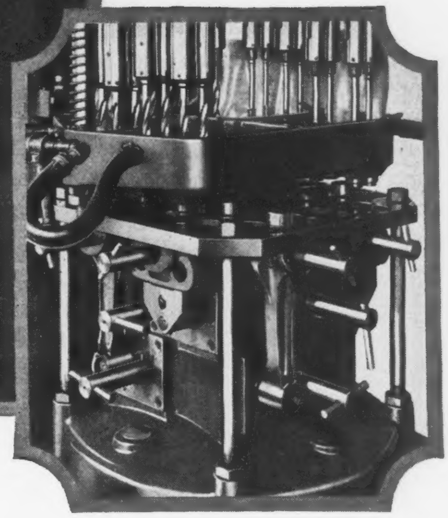
Cleanliness in the Shop Prevents the Spreading of Infection

According to Nelson N. Marshman of the Cleanliness Institute, New York City, a cleanliness campaign instituted in a large machinery plant in January, 1926, has kept the plant free from epidemics of boils, such as had previously given much trouble. The cause had been attributed to contact with cutting oils, although many workmen who did not use cutting oils were afflicted, the infection obviously being spread by blueprints and other materials that passed from hand to hand.

When it was explained to the men that bacteria of pus-producing variety caused the boils by becoming buried under the skin around the hair follicles, and that the infection was spread by direct hand contact, the workmen realized the necessity for frequent and thorough scrubbing of the hands. Anything that looks like a pimple is now thoroughly cleaned at once, a wet dressing applied, and the boil fails to materialize.



Design of Tools and Fixtures



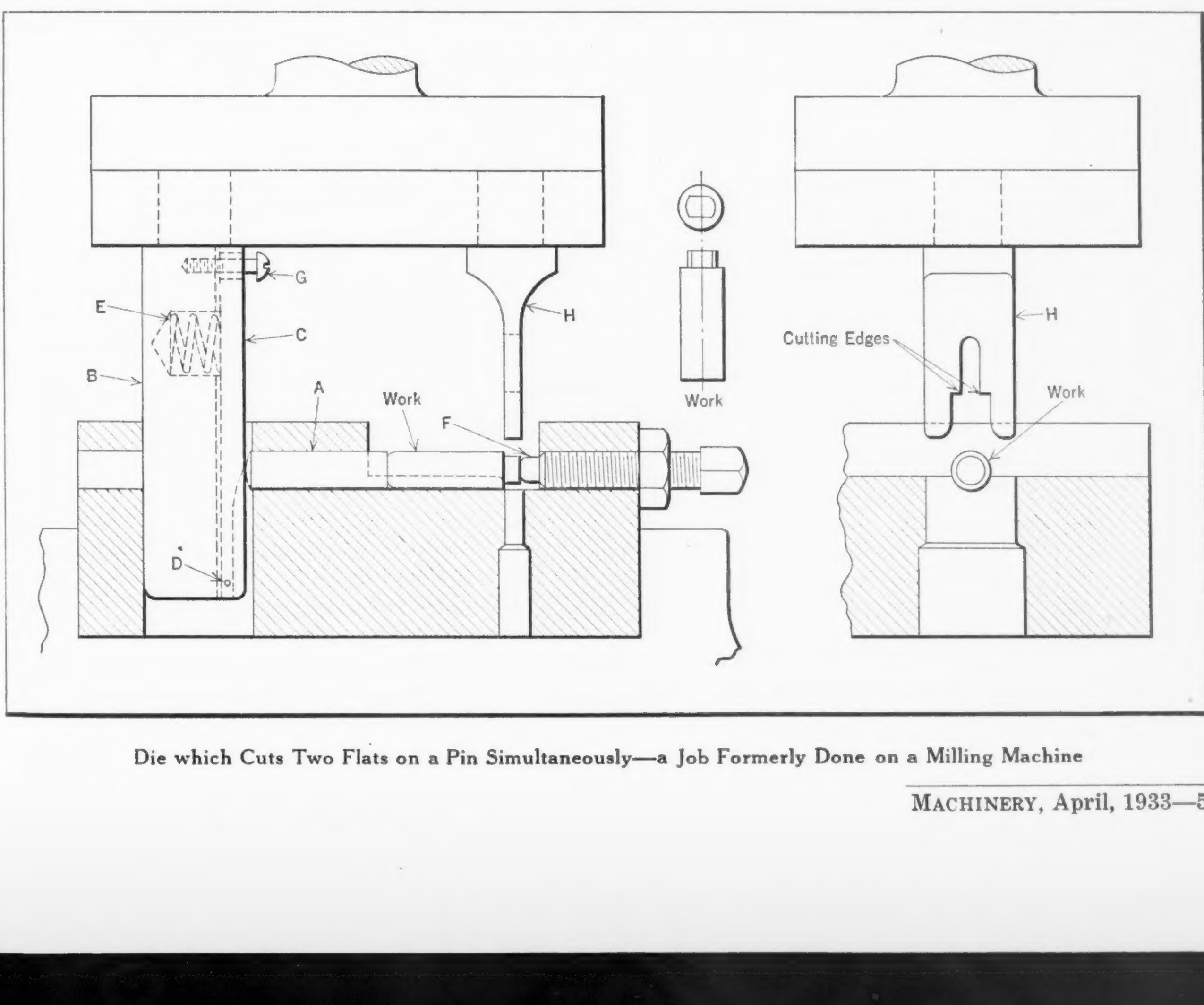
Die for Cutting Parallel Flats on Round Pins

By PETER L. BUDWITZ, Meriden, Conn.

The press tools here illustrated were made for cutting the two flats on the brass part shown in the detail view. This operation was previously done on a miller, but it was found that it could be performed more economically on a press. The stock is removed from the part by punch *H*.

The work is locked in a semicircular nest by the clamping plunger *A*, which is actuated by cam *B*, secured to the punch-holder. Cam *B* is designed so that any variation in the length of the work is compensated for by cam leaf *C*. This leaf is hinged on pin *D* and backed up by the stiff coil spring *E*.

As the ram descends, cam *B* actuates plunger *A*, forcing the work against stop-screw *F* and locking it securely before the punch starts cutting. As the ram descends farther, the punch enters an opening in the lower die member, which serves as a guide for the punch and supports it while the cutting is being done. When the stroke is completed, the punch is returned and is clear of the work before the work is released by plunger *A*. In this way, the



Die which Cuts Two Flats on a Pin Simultaneously—a Job Formerly Done on a Milling Machine

work is prevented from sticking in the punch. Plunger *A* has a spring (not shown) attached to it for the purpose of keeping it against the cam surface. Screw *G* serves as a stop for leaf *C* and is adjusted so that the leaf has the proper amount of motion.

Although not necessary for the job described, provision can be made in this die—such as a spring pad in the punch-holder—to prevent tilting of the work while the cut is being taken.

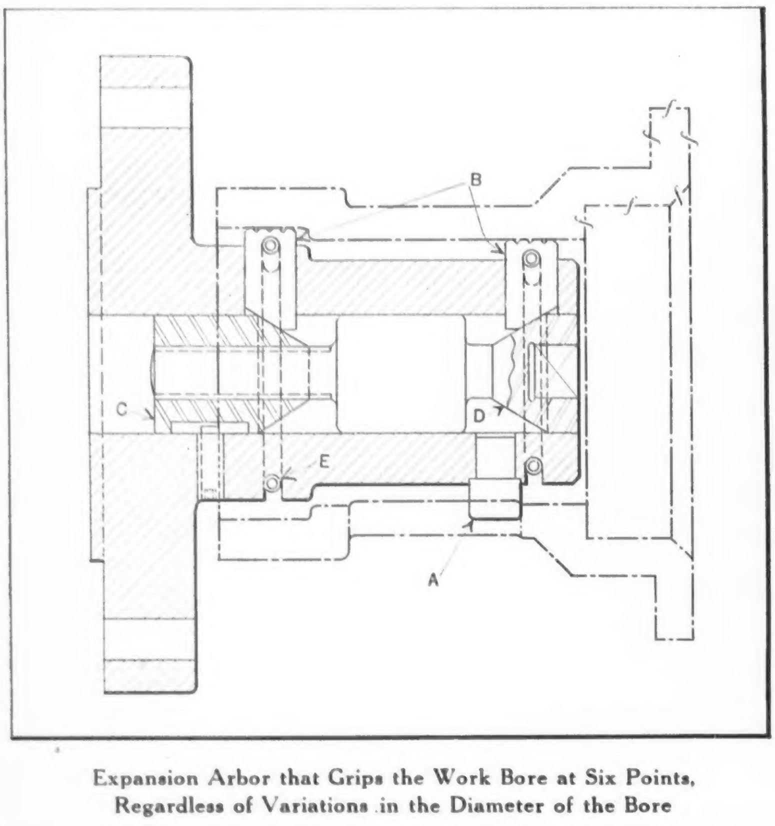
Expanding Faceplate Arbor for Cored Holes

By D. L. BROWN, Summit, N. J.

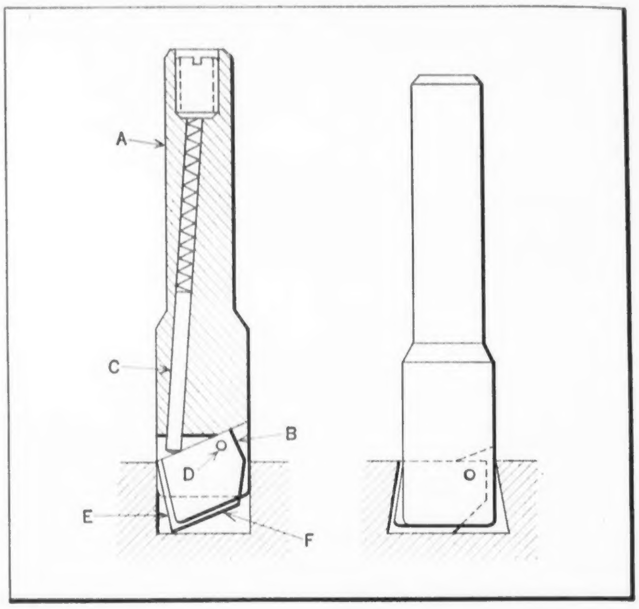
A faceplate arbor recently made for holding a pinion housing during the first machining operation is shown in the illustration. It was required that the work be machined concentric with the cored hole in the casting. The work, shown by dot-and-dash lines, is located endwise by means of pin *A* which enters a hole in the casting wall. This pin also serves as a work-driver.

The work is held by the three sets of expanding jaws *B*. Each set is expanded by means of the tapered plugs *C* and *D*. Plug *C* is prevented from rotating by a set-screw which engages a slot in the plug. Plug *D* has a square socket for a standard wrench, and is threaded to fit plug *C*. By screwing plug *D* into plug *C*, both plugs are moved toward each other, causing the jaws to move outward and grip the work. Unscrewing plug *D* causes the jaws to contract enough to allow the work to be removed from the locating pin.

Two coil springs *E* passing through holes in the jaws and confined in annular grooves in the arbor body keep the jaws in contact with the tapered portions of the plugs. With this arrangement, any variation in the diameter of the casting core will cause the plugs to shift or float until all the jaws are in contact with the core.



Expansion Arbor that Grips the Work Bore at Six Points, Regardless of Variations in the Diameter of the Bore



Boring Tool in which Contact with the Bottom of the Hole Causes the Cutter to Swivel into Position for Boring the Tapered Recess

Simple Tool for Boring a Tapered Recess in a Blind Hole

By WALTER E. TOBOLSKI, South Bend, Ind.

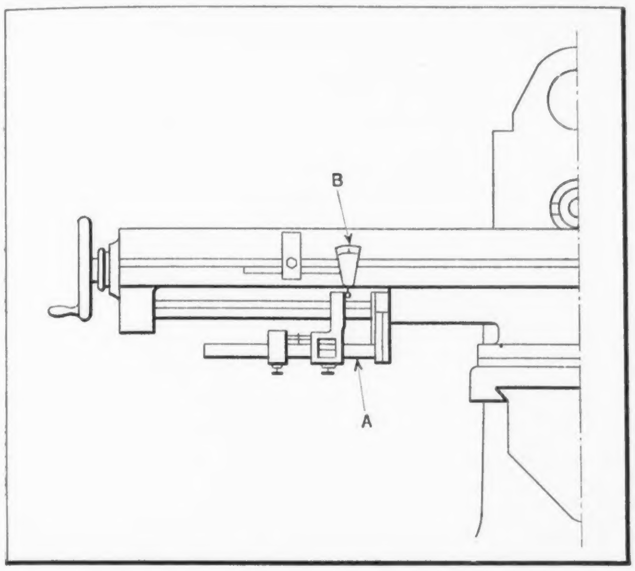
The simple design of the tool here illustrated for boring tapered holes, the large diameter of which is at the bottom of the hole, typifies the economy generally striven for in tool design. In the hole is pressed a rubber stopper, the tapered portion of the hole keeping the stopper in place permanently.

The tool for cutting the tapered recess consists of the bar *A*, the swivel cutter *B*, and the spring pin *C*. As indicated at the left, a straight hole is drilled in a previous operation. The cutter is shown in the position in which it is normally held by the spring pin. The heel of the cutter is flush with the outside of the bar to allow the bar to enter the straight hole.

When the lower point of the cutter comes in contact with the bottom of the hole, further feeding movement of the bar causes the cutter to swivel on pin *D* until

it assumes the position indicated in the right-hand view. Here it will be seen that the bar has been fed toward the work until cutting edge E is in position for boring the hole to the required taper.

The edge F of the cutter is rounded sufficiently to prevent any cutting action at the bottom of the hole. Obviously, in removing the bar from the finished hole, the movement of the cutter will be the reverse of that described, so that there will be no cutter drag. Chip clearance is provided on the bar just ahead of the edge E of the cutter.



Vernier Height Gage and Indicator Secured to a Milling Machine to Facilitate Accurate Spacing in Boring Holes

Precision Spacing for Holes Bored in a Milling Machine

By EUGENE L. SOLTNER, Philadelphia, Pa.

A convenient method frequently used by the writer for accurately locating holes for boring in a milling machine is described here. In order to make the method clear, suppose that it is required to bore six holes in a jig plate, these holes to be exactly 1/2 inch apart and all in line. As a rule, no extreme care need be taken in locating the first hole. If, however, accuracy is essential, this hole can be located by using a button or center indicator.

After boring the first hole and before moving the table, clamp a height gage to the saddle of the machine, as indicated at A. Then secure an indicator B to the table, as close to the base of the height gage as convenient. Now move the sliding jaw of the height gage along the bar until the indicator registers zero. Note the height-gage reading at this point and then move the sliding jaw 0.500 inch toward the left. The sliding jaw is now clamped in position, and the table is moved until the indicator again registers zero, when the second hole is bored. This procedure is repeated until all the holes are bored.

Care must be taken to see that all backlash is taken up in the sliding jaw of the height gage and that the indicator registers at the same graduation for each hole. The method described is intended for horizontal spacing only. Hence, unless a similar arrangement is provided on the vertical feed, the less accurate machine graduations must be used for vertical spacing.

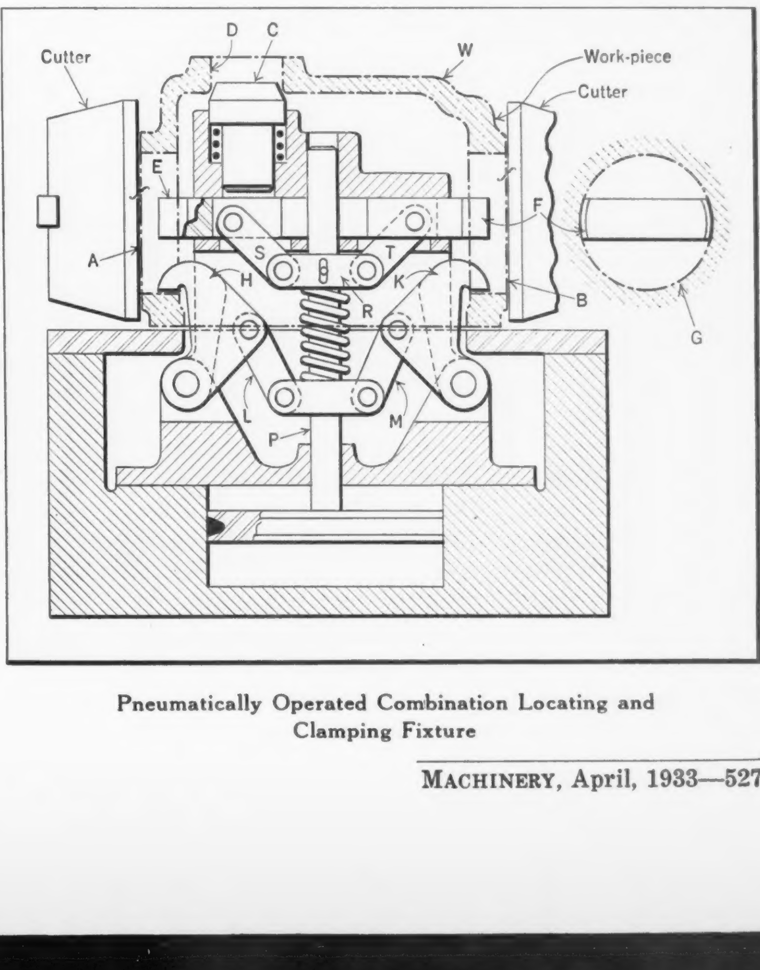
Combined Locating and Clamping Fixture

By FRANK W. CURTIS, Research Engineer
Kearney & Trecker Corporation, Milwaukee, Wis.

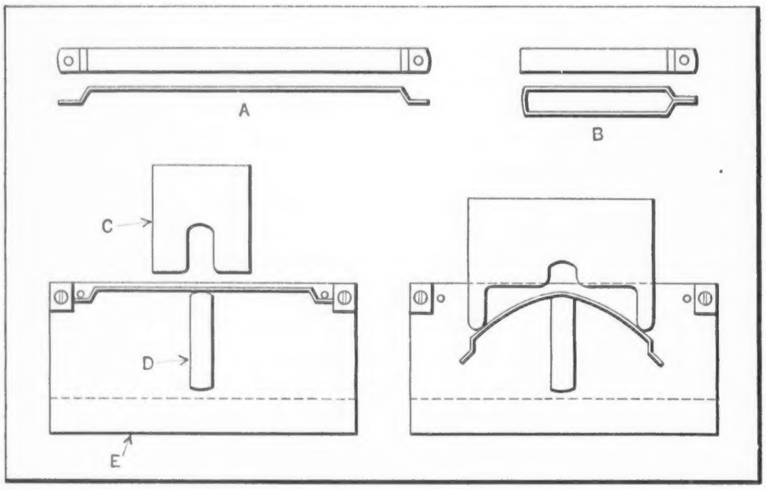
When it is possible to design fixtures so that the clamping, aligning, and locating of the work can be done by a single lever, the output is usually increased, because the loading can be done more quickly. An air-operated fixture in which these features have been incorporated is shown in the accompanying illustration.

The casting W, which is to be faced on sides A and B by the straddle milling cutters, rests on its previously faced base. End location is provided for by the spring pin C, which is tapered at the end to enter the rough cast hole D. Radial alignment is attained by the sliding plates E and F, which fit into the cored holes at each side, as at G. These plates are also tapered at their locating ends.

The clamping of the work-piece is accomplished



Pneumatically Operated Combination Locating and Clamping Fixture



A Tight Contact was Obtained between the Ends of Part B by Redesigning the Forming Punch C to Bow the Part, as Indicated at the Right

by two clamps H and K, which are pivoted on pins and operated by the links L and M. These links are connected with the vertically operated plunger P, to which is also connected the plate R, which operates the links S and T attached to the sliding plates E and F.

Since the clamps and sliding alignment plates are all coordinated with the vertical plunger, the action is such that the work is aligned and clamped simultaneously when the plunger is raised. By reversing the motion of the plunger, the sliding plates are withdrawn and the clamps are pivoted inward so that the work can be removed.

An air cylinder is used with the fixture described, although the vertical plunger could be operated by a rack and pinion connected to a lever and self-locking clamping unit or by various other means. Air was adopted for this fixture because it was available on the machine used.

Forming Die that Compensates for "Spring-Back"

A number of pieces, punched and formed as shown at A in the illustration, were to be formed to the shape indicated at B. The material used was cold-rolled strip stock, 1/32 inch thick. One of the requirements was that the ends of the finished piece be brought tightly together, so that if spread with the fingers, they would immediately spring together again. As the number of pieces to be made did not warrant the construction of a complicated die, the simple form of die shown at the left was made.

The pieces were centralized and held in position by a block and pin on each end of the angle-plate E, the forming punch C bending the work around the stationary block D. It was found, however, that the stock was so flexible as to cause the ends of the work to remain apart after forming.

This difficulty was overcome by changing the design of punch C, as shown at the right. Here the work is bent first by the side fingers on the punch. This produces a "kink" in the material on each side of the block. Thus, as the center groove in the punch makes the middle bend around the block, the kinks will be ironed out, leaving sufficient tension in the strip to cause the ends of the work to be held together with the required tightness. R. H. K.

Milling Fixture of Swivel Type for Rounding the Ends of Chain Links

By EDMUND E. BURKE
Kent-Owens Machine Co., Toledo, Ohio

The illustration shows a simple milling fixture and set-up for rounding the ends of Nichrome links used in a conveyor chain. A finished link is shown on the knee of the machine. The machine head is locked in position at the proper height, and the table feed is used only to feed the work to the cutter and withdraw it after the cut is completed.

The fixture consists of a baseplate clamped to the machine table. On this plate is the work-holder which rotates about a pivot pin through an arc of 180 degrees. The work is clamped to this holder by means of a cam operated by a long lever. The machine table is shown in its loading position. After the piece has been clamped in position, the table is fed forward until the pivot pin is in line with the center line of the cutter. The fixture is then rotated through 180 degrees by means of the long lever on the work-holder. This fixture is in regular use and has proved very satisfactory in both the quality and quantity of work produced.

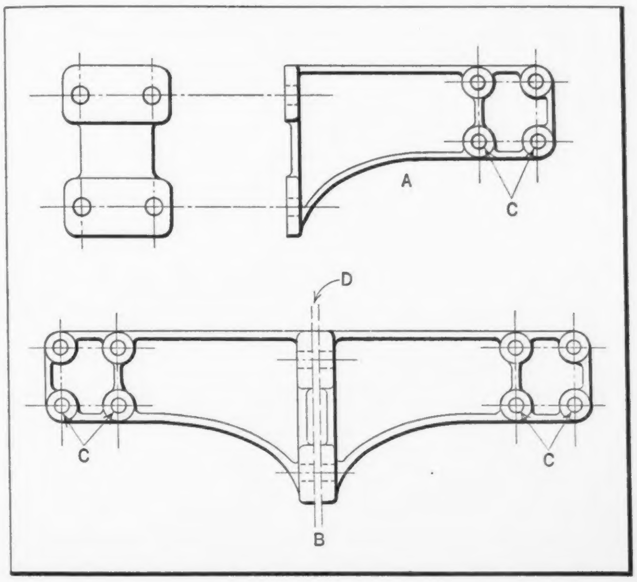
Swivel Fixture for Rounding the Ends of Chain Links on a Hand Miller

Ideas for the Shop and Drafting-Room

Time- and Labor-Saving Devices and Methods that Have been Found Useful by Men Engaged in Machine Design and Shop Work

Reducing Costs by Casting and Machining Two Parts as One Piece

The cost of machining cast parts like the one shown at *A* in the accompanying illustration was reduced approximately 30 per cent by casting two of the parts in one piece as at *B*. The casting *A* was



Views Illustrating Method of Casting Two Parts in One Piece to Reduce Costs

originally machined in three operations as follows: First the base was finished, then the base holes were drilled, and finally the holes shown at *C* were drilled. Besides providing for a more economical method of machining, the larger casting, obtained by casting two pieces together, made it possible to obtain a lower rate per pound from the foundry.

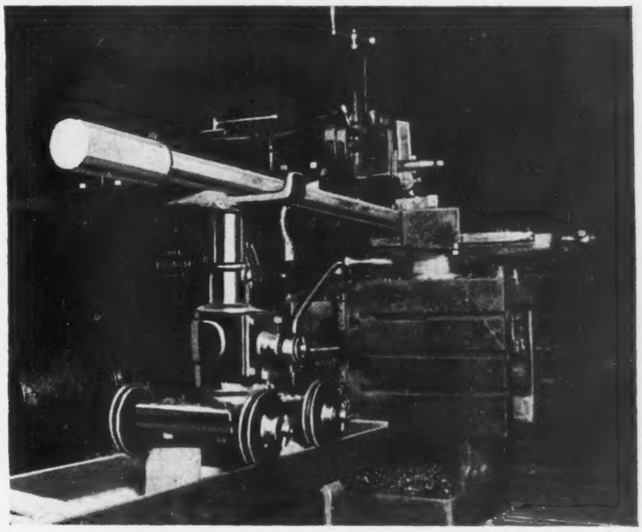
In machining the double casting, the first step was to place it in a jig and drill the holes at *C* in both castings at once by means of multiple-spindle drilling equipment. Thus a single handling and clamping in the jig sufficed for the two pieces. Next, the base holes were drilled. In this case, again, only a single handling was required for the two pieces, as the drill was fed through both base lugs. The double casting was then located on a milling machine table from the holes at *C* and the two pieces cut apart as indicated by the dotted lines at *D*. The latter operation served to finish the bases of both castings as well as to separate the two pieces.

Webster, N. Y. ERNEST C. ALLEN

Traveling-Carriage Support for Use in Machining Heavy Work on Shaper

The traveling-carriage support shown in the illustration enables heavy parts to be planed without throwing the shaper and work out of line. This arrangement consists of four principal members—a 25-ton journal jack with a crank-handle attached where the ratchet lever is ordinarily fastened; a base with four concave wheels mounted on two axles to fit a track; a track 12 inches wide and 5 or 6 feet long, made of structural channel irons, which is placed in the position shown and fastened on two supports secured to the floor with anchor bolts; and a U-shaped support which is welded to the top end of the jack adjusting column for the purpose of supporting the work.

It is an easy matter to level any heavy part by turning the crank-handle to the right or left, as required, for raising or lowering the U-shaped support. The device travels on the track in the same direction and at the same rate of feed as the



Handling Heavy Work on a Shaper Equipped with Traveling Support

shaper table, thus eliminating any danger of the free end dropping down and throwing the work out of line or damaging the chuck and shaper table. The particular support shown in the illustration is used in a locomotive shop for supporting such parts as guide-bars, valve-gear parts, and locomotive frame sections.

Chattanooga, Tenn. H. H. HENSON

Equipment and Methods Used in Molding Plastic Materials

Molds and Presses of Various Types Have Been Developed to Facilitate the Production of Parts from Plastic Materials Such as Bakelite and Durez

By C. W. HINMAN

MOLDS for plastic materials, such as Bakelite and Durez, are made in four types known as hand molds, semi-hand molds, semi-automatic molds, and full-automatic molds. All types are used in presses of similar design. The presses are usually of the four-post, vertical type, and are about six feet in height. The posts of these presses are approximately 4 inches in diameter and are set to give a tool space about 36 inches wide by 21 inches, front to back. Other presses for large or heavy work are built to greater dimensions.

Methods of Heating and Operating Press Platens

The ram platen (usually the lower member) is operated hydraulically by a piston underneath the platen. In closing the mold, the ram platen moves up toward the stationary platen above. The piston ram is about 8 to 10 inches in diameter. A steam coil, provided in both the upper and lower platens in hand molding presses, furnishes the necessary heat for molding. The heat varies from approximately 190 degrees F., for soft rubber work to 450 degrees F. for Bakelite, and up to 600 degrees for other work. In large automatic molds, steam coils that lead between the cavities of the block provide the necessary heat.

An asbestos board between the upper platen and the press head to which it is attached prevents loss of heat by radiation. A steam trap frees the steam coils from condensation. Some presses are equipped with electrically heated platens having an automatic temperature control. The pressure used between the two platens ranges from 50 tons up, depending upon the area of the molds and the kind of material molded. The pressure is produced hydraulically by the use of either oil or water.

Operation of Hand Molds

Hand molds weigh between 80 and 100 pounds, and are not intended for high production. The plunger and the cavity block of a hand mold are not positively attached to the press platens, as in the case of a semi-automatic or a full-automatic mold. The cavities are loaded with the plastic material which, for Bakelite, is a fine resinoid powder or a "pill" or semi-molded "biscuit." After the cavities are loaded, the plungers, which are attached to a plate or plunger-holder, are placed over the cavity block. Two or more guide pins serve to align the molding members while the plungers are being lowered into the cavities.

The loaded mold is pushed into the press between the upper and lower platens. Hydraulic pressure is then applied by a cylinder under the ram, and the molding operation begins. After the piece is completed, the mold is placed in a "cold press" which exerts about 8 tons pressure. Cold water is circulated through the platens of the cold press in place of steam.

Production Capacity of Hand Molds

The time required to melt the powder and to form the piece under pressure in the mold depends upon the size of the work and the number of pieces made. Extreme cases might be mentioned where an automatic mold for Bakelite bushings produced as many as 300 pieces at one time. For pieces similar to ash trays, from eight to twelve pieces are made in an automatic mold and two pieces in a hand mold, while a hand mold for an electric clock case may have a single cavity.

One of the best speed records for a hand molding operation is 600 pieces an hour from a single press using two nine-cavity molds. The time in the press was forty seconds, and the transfer time five seconds. The wall thickness of the molded part was 1/16 inch. In considering molding speed records, it should always be remembered that excessively short curing time does not impart the maximum properties claimed for phenol-resinoid material. Two or three molds are generally used for hand molding so that loading, molding, and cold press operations are performed simultaneously.

Blanks or "Biscuits" of Compressed Molding Powder Reduce Molding Time

The time required for molding operations can be materially reduced by using "pills," "biscuits" or "tablets" for loading the cavities instead of powder. These "pills" or "biscuits" have an average volume of approximately 1 1/2 times that of the finished piece. The blanks or "pills" are previously compressed from the powder in a separate press. The "pill," "biscuit," or "tablet" mold is automatically fed with the powder by a swinging hopper which pushes aside the previously compressed blank after it has been ejected.

Using a Loading Tray for Multiple Molds

In using multiple molds for a large number of small pieces, a feeding tray is employed for placing an individual charge of powder or pill in each of the cavities. The tray is made from aluminum sheet, 1/4 inch thick, having a series of holes spaced to correspond with the cavities. Tubes are inserted in the holes in the tray. Each tube is filled with a charge, after which the tray is positioned over the cavities. A sliding plate that serves to open or close the tubes is then slid back, allowing the charges in the tubes to enter the cavities.

Unit Construction for Multiple-Cavity Molds

Molds having a large number of cavities are seldom made with the cavities in one solid block, but with each cavity in a separate block. The separate blocks are then fastened together on a plate or in a retaining frame. The plungers are also made as separate parts and then assembled. Thus a forty-cavity mold, for example, would consist of forty units, each unit with a separate cavity and plunger. This construction permits individual units to be replaced in case of breakage.

When a hand mold is withdrawn from the cold press, it is turned over and placed on two parallel bars attached to the bed of an arbor press. The bars support the mold on both its outer edges, but clear the plunger plate, which is usually removed first.

A pin stripper plate is inserted above the cavity block, its pins entering the holes in which the plunger plate pins in the block are located. The stripper pins, when moved down by the arbor press ram, cause the plungers to be evenly pushed away from the mold without injury to the finished work. If there is another plate to be removed from the opposite side, the block is turned over on its opposite face, and the arbor press operation is repeated.

Operation of Automatic Molds

In automatic molds, the cavity block is positively attached to a sub-plate on the ram platen, and the plunger plate is likewise attached to the upper platen. Steam for heating the mold is conducted through holes in the sub-plate. When the ram recedes and the mold opens, the work usually adheres to the member that carries the core-pins. A pin plate, suitably mounted in the press, is actuated by the lowering of the ram, and strips off the finished work. The operator inserts a light tray under the work before the stripping occurs, and thus collects the pieces when ejected.

If the work must have an accurate interior opening, the pieces while still hot are placed over sizing studs on another plate, where they are allowed to cool. The sizing studs are slightly tapered so that the work can be easily removed; and if there are large numbers of the pieces, a pin stripper plate is used.

If the work is so shaped that the parts remain in the cavities when the mold members are separated, a pin stripper plate attached to the upper platen and operated from below by four hooks, ejects the work as the ram recedes. Gloves are worn as a protection against burns when handling the heated tools and the work.

Operation of Semi-Hand Mold

The semi-hand-operated mold is opened in the press and usually only one-half is removed for ejection, cleaning, and reloading purposes. This tool is somewhat faster than the hand mold and can be used for heavy production when the heated platen type press is used. It has an advantage over the hand mold in that larger pieces or a greater number of pieces can be accommodated, due to the fact that the handling weight is divided between the two halves. This reduces the element of fatigue, which is a big factor in production costs.

Features of Semi-Automatic Mold

The semi-automatic mold is one in which the halves are mounted solidly in the press. The heating chambers are integral with the cavity block and both the opening of the mold and the ejecting of the parts are effected by the operation of the press. This class of mold is used for parts that are too large to be handled in the semi-hand mold, when the required production warrants the use of a greater number of cavities than is permissible in the former classes, and when the total production cost justifies the greater tool expense.

High Production Obtained with Automatic Mold

With the automatic mold, the entire molding procedure is accomplished in the press. The field for this type of mold is restricted to parts made in very large quantities. For example, one firm operating 125 presses for the production of storage battery boxes, shipped about eighteen carloads of the finished product daily when automobile production was at the peak. In battery box molding, the composition material is mixed with light tough fiber as a binder. The material, of a soft wax-like consistency, is weighed in chunks of sufficient size to make one box. The pieces are next heated to a plastic state, suitable for molding, while being rotated in a gas-heated oven, and are then placed in the molds and formed by the closing of its members. The molds are not heated, but are kept warm by the preheated material.

Molds using Bakelite resinoid powder should have cavities that take approximately three times as much powder, in cubic inches, as there are cubic inches in the finished piece. This rule varies, however, with the kind of material used. The height of the powder line in the cavities should be such, and the plunger shoulders should be so designed,

that the cavity opening is closed before the plungers enter the powder; otherwise, some of the material will escape. Work of a flat design, like a typewriter spacing bar, may warp if unevenly heated. The position of the cavity in the mold should insure equalized heat from above and below. The heat may be equalized by increasing or diminishing it on one side, as required.

Characteristics of Molded Parts

Each piece of molded plastic material leaves the hardened mold exact and accurate in all its dimensions, and faithfully mirrors the luster of its polished surfaces. Bakelite molded stock colors can be had in about fifty different tints. First are the several tints of yellow, then the shades of orange and green, eight shades of blue, then the maroons, walnut, oak, several shades of brown, and finally black.

The fundamental principles in the design of plastic molds are similar to those followed in die-casting. When an interior or exterior pattern has a raised or a depressed design which interferes with the removal of the finished piece, the interfering part is carried on a sliding insert that can be independently withdrawn.

The molding members are given a slight draft to facilitate the removal of the pieces. They are highly polished, the final polishing lines being parallel with the direction in which the work is removed. Chromium-plating is being successfully utilized on plastic molding members to retard wear and prevent pitting, corrosion, and discoloration. It offers a permanent non-tarnishing luster, so necessary in the majority of cases, due to its inert chemical characteristics.

Shrinkage Allowances for Molded Parts

Shrinkage allowances are usually determined by experiment and depend upon the shape and sectional areas of the work. For Bakelite, the shrinkage allowance may be from 0.004 to 0.012 inch per inch on the completed piece. Nevertheless, with correctly designed molds and proper care in molding, an accuracy of 0.002 inch per inch on the finished work is quite within the limits of Bakelite molding. Such accuracy, however, will increase the cost per piece because of the extra care required, and should not be specified unless really necessary. For most purposes, a tolerance of 0.005 inch, plus or minus, is sufficient.

Selecting and Treating Materials Used for Plastic Molds

While low-carbon steels have been used successfully in the construction of molds for parts requiring no great accuracy or fine finish, it is best to avoid cheap materials. When so much time and work are involved in building even an ordinary mold, experience has shown that it is good practice to use the best materials obtainable.

Molds have been made from machinery steel, pack-hardened, and used with satisfactory results for a long time. There is always danger, however, that the surfaces of some working member may become inaccurate or "pitted" when subjected to the necessary heat and pressure, due to lack of strength below the carburized surface.

The molding surfaces must possess sufficient hardness and strength to sustain the operation without appreciable change. The usual hardness required is 68 to 72 scleroscope, or 53 to 55 Rockwell. The steel used must not warp or otherwise change its shape or size in hardening, which means that an oil-hardening tool steel is best for the purpose. Oil-hardening manganese or vanadium tool steels have given best results, but these must contain sufficient carbon, that is, 0.80 to 1.00 per cent carbon, to harden well in oil. Tool steels that contain tungsten, while considered very good for cutting dies, do not give the desired results when used for molds.

In hardening molds and plungers, great care must be exercised to obtain an even heat and hardness. The steel treating instructions furnished by the mill should be carefully observed, and overheating must be avoided. After hardening the piece, it should be cooled very slowly and redrawn, preferably in an electric furnace, until the desired temper is obtained. The drawing heat should be at least 450 degrees F. or whatever the working heat of the mold will be when in use.

* * *

How to Braze Carboloy Tools to Shanks

Complete instructions for a simplified method of making Carboloy tools in the user's plant are given in a booklet recently published by the Carboloy Co., 2481 E. Grand Blvd., Detroit, Mich.

With these directions for making his own tools, the manufacturer need purchase only the Carboloy tip or blank, at a price considerably less than that of the finished tool, and can make the rest of the tool in his own shop. In this way, he makes a saving in the initial investment and also employs his own labor. In the small shop, where there is a diversified line of work, with only limited production of any one part, this method will prove particularly advantageous, as the investment economy widens the range of work on which cemented-carbide tools can be economically applied. The book also describes how Carboloy tips can be removed from their shanks without injury to either tip or shank. In this way, a single tool tip can be used for several different types of jobs.

The instructions in the booklet cover fully the machining of the shank and the brazing of the tool tip to the shank. No equipment, except that available in any machine shop, including an oxy-acetylene torch, is required.

Making Molds and Dies by Three-Dimensional Engraving Process

With this Process a Model of the Part to be Engraved Guides the Engraving Cutter Through a Three-Dimensional Pantograph System

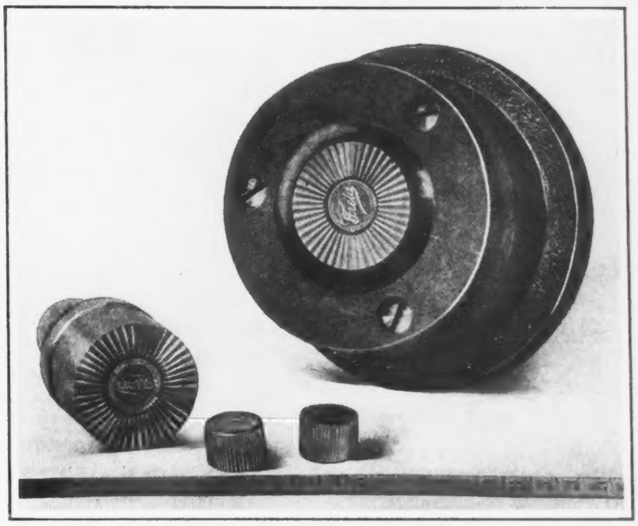


Fig. 1. Stamping Die Made by Three-dimensional Engraving Machine Shown in Fig. 2

THE cavities in forming, stamping, or forging dies, such as shown in Figs. 1 and 3, as well as raised-letter nameplates, molds for synthetic plastics, embossing rolls, and various other kinds of work with raised or sunken profiles, can be engraved on the three-dimensional engraving machine shown in Fig. 2. A full-sized or enlarged model of the cavity or profile to be produced in the die is mounted on the tracing table of the machine. This model serves to guide the engraving tool so that the profile of the model will be accurately reproduced.

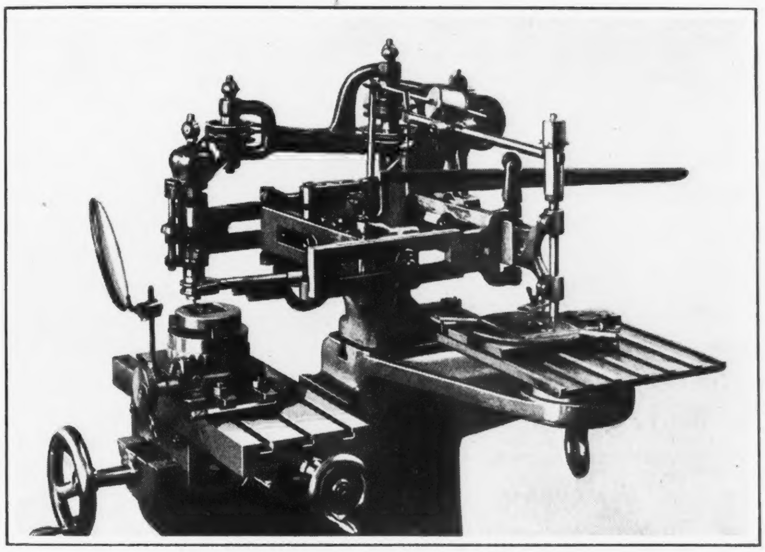


Fig. 2. Pantograph Engraving Machine Equipped with Cutter-spindle having Vertical as well as Horizontal Movements Controlled by a Tracer in Contact with the Model

In forming a cavity in a die such as the one shown in Fig. 1, an enlarged copy or model is mounted on the tracing table at the right. The die-block to be machined is mounted on the table to the left. The tracer or stylus is then guided over the surface of the model, causing the engraving tool to form the cavity.

The model may be made of fairly soft material or a cement prepared especially for the purpose. The pantographic system of levers, which enables the contour of the model to be copied, can be so adjusted that the rotating engraving tool will have exactly the same movements as the point of the tracer or stylus, giving a 1 to 1 ratio, or so that any desired ratio up to 1 to 10 can be obtained, as well as any desired reduction. Fig. 3 shows examples of copying work done in a ratio of 1 to 1.

The two-dimensional pantograph arrangement, which provides for movements in a horizontal plane, is similar to that commonly used for a flat engraving. The pivoting points are provided with ball bearings and the engraving tool spin-

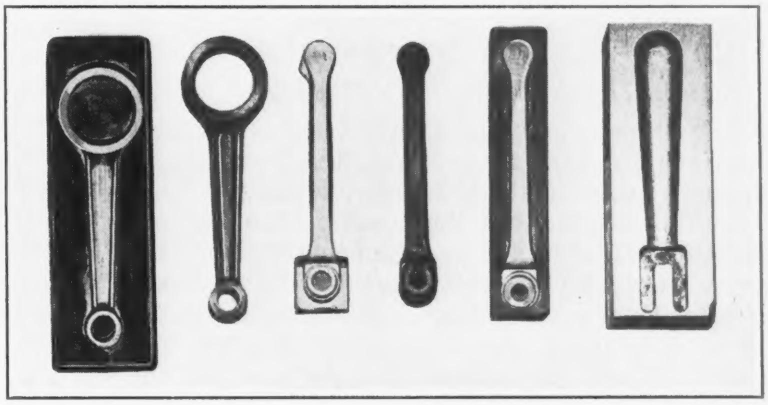


Fig. 3. Examples of Dies with Cavities Engraved on Machine Shown in Fig. 2, Using a Model the Same Size as the Work

dle runs in adjustable tapered bronze bushings. The system of levers that causes the cutter to be raised and lowered vertically, in synchronism with the vertical movements of the tracer or stylus, is shown in Fig. 2. One of the pivoted levers has its outer end connected to the upper end of the tracer. The other end of this lever is connected with a vertical rod that is connected to a second pivoted lever. At the end of the second lever is a trunnion yoke which engages a flanged groove or collar on the engraving cutter spindle.

With this arrangement, the tracer and the cutter are raised and lowered vertically, so that profiles having straight sides at an angle of 90 degrees with the base of the horizontal plane can be machined. The makers of the machine described, Curd Nube, Maschinenbauanstalt, Offenbach am Main, Germany, whose agent in this country is John Hisgen, 117 W. Lake St., Chicago, Ill., employ a similar pantograph system in special machines for engraving the treads in automobile tire molds. Machines of the latter type have been made in sizes suitable for engraving molds ranging up to 75 inches in diameter.

Reconstruction of Industry by Direct Action

By GEORGE PAULL TORRENCE, President, Link-Belt Co., Chicago, Ill.

In this article, an industrial leader counsels courageous methods in dealing with the present tangled problems of industry. In addition to his suggestions regarding industry, Mr. Torrence has also made some specific proposals for the rehabilitation of agriculture. His suggestions for more rational methods in the controlling and managing of the major industries of the country, especially those producing raw materials, will compel the attention of all who are giving thought to the future of industrial activity.

THE raw materials industries are just as much in need of firm handling as agriculture; and properly handled, the benefit to the general public would be great. As in the case of agriculture, prices are controlled largely by supply and demand. Conditions differ, but the solution can be much the same if the industries are exempted from the provisions of the anti-trust laws.

The anti-trust laws were enacted to give protection from the unfair methods of selfish individuals who controlled industries for their own advantage to the detriment of the small competitor and the public. Personal integrity and unselfish interest in public well-being have not progressed to the point where the safeguards of the anti-trust laws can be abandoned without a substitute that will compel any industry to act for the public good.

The Coal Industry Needs Immediate and Courageous Action

The bituminous coal industry has suffered ever since the war from the evils resulting from excess-producing capacity. Losses, receiverships, reduced wages, destitution are the results. Many things have been tried by the managements without success. More recently, an intelligent effort at cooperative marketing was declared illegal, as being contrary to the provisions of the anti-trust laws. The Supreme Court has softened this decision, but the anti-trust acts still limit action.

The bituminous coal industry can be made a good industry for its owners and workers, and, therefore, for the public generally. Let Congress declare that the bituminous coal industry is exempt from the anti-trust laws, and at the same time give the Federal Trade Commission full power to pass on any rules and regulations governing the industry before they are put into effect, thus letting the Federal Trade Commission judge what is for the public good, as well as for the good of the industry. As a safeguard, the law should provide that the rulings can be appealed before the Supreme Court by any interested party.

The rules made should be binding on the industry. This could be made effective by a system of licensing or by some other means. The rules could include limitation of output, cooperative sales agencies, specifications of the coal itself, prices and terms of sale, labor rates, consolidations, closing of mines, and anything that is required to make the industry orderly, efficient, and profitable.

The managements of the mines presumably know more about the business than any other persons. Through a trade association they should make the rules and appoint the dictator or director to enforce them. The trade association should represent at least 75 per cent of the industry. The Federal Trade Commission should hear any minority recommendations on any rules before it, for approval or alteration.

In addition to the control exercised by the Federal Trade Commission, the competition of other industries will keep the prices of bituminous coal equitable. Oil, electricity, and hard coal are all com-

petitors for the consumer's dollar, and, therefore, a correction for too high prices.

Lumber needs aid as much as coal, and could be helped in the same way. Making the coal and lumber industries good industries would have a tendency to conserve the coal and lumber resources.

Two Other Basic Industries—Oil and Steel—Should be Included in the Plan

To conserve a national resource and avoid the waste now existing, as well as to improve the well-being of the people involved, the oil industry should also be given a chance to regulate itself legally under Federal Commission supervision, and to coordinate and improve the regulation that already exists. The only manufacturing industry that should be included at once is the steel and iron industry—this because it is the largest basic manufacturing industry and affects many other industries.

Sound handling of these industries would compel adjustments in the lives of individuals, but these adjustments, made wisely and in a friendly fashion, would be vastly better than the continuing distress caused by false hope that the present excess capacity will be required in the near future.

If these plans are good for bituminous coal, lumber, oil, and steel, they should also be good for other industries, but any such plans are partially experimental and involve the development of a technique that does not now exist. Presuming good intention on the part of all concerned, and competent leadership, the plan will work; but it is wise to confine it to the few industries needing it most until after the technique is developed. The stabilization of these industries could be accomplished without swamping the Federal Trade Commission. With successful history in connection with these as a guide, the plan can be extended later.

In the meantime, much can be done in other industries, and in retail and wholesale distribution, provided the members of these groups face the facts. First, there is no such thing as an unlimited market—at least not now. Second, capacity in excess of probable demands is a loss, and should be so considered. Third, it is unsocial as well as unprofitable to operate a business at a loss. Fourth, volume at ruinous prices is suicide. Fifth, the development of new products, opening new markets at profitable prices, is the only wise way to utilize excess capacity. Sixth, it is possible to operate at half capacity or less and still make a profit. Seventh, industry and business are social enterprises to be operated for the mutual benefit of the owners, the workers, and the public.

What Every Industry May Do Even Under Present Laws

The anti-trust laws prevent agreements that limit competition. They do not prevent the adoption of wise policies by any one firm, and they do not, and never were intended to, prevent the adoption of the same wise policies by other firms. To adopt the policies of others, means a willingness to follow and aid wise leadership. If a company is part of a good industry that is intelligently and honestly trying to keep that industry sound, usually that company is making a profit. If, on the other hand, the individuals in an industry are blindly trying to grasp every selfish advantage, the industry is unprofitable, and, therefore, a hazard to itself and to all others. There must be a profit margin to individuals and to business enterprises, if we are to go forward. A successful business can be conducted without the repeal of the anti-trust laws.

The establishment of industry dictators would be a partial revival of the powers of the War Industries Board in the Federal Trade Commission and the Federal Farm Board; this time the object would be to limit production and raise prices. The emergency is just as great as in 1917, and just as definitely calls for prompt direct action, with the President in executive control.

In Machinery Next Month

At first welding was a matter chiefly concerning the welder. His skill in insuring a strong joint was the main consideration. Today welding has become a problem for the designer. Welding, from the designer's point of view, will be discussed in MACHINERY next month.

The heat-treatment of broaches is another phase of shop practice that will receive attention in May MACHINERY. One of the most delicate operations handled in the hardening room is that of hardening broaches. Some useful information will be given on this subject. There will also be an article on the use of hard chromium plate in the shop.

Other items that will interest wide-awake mechanical men are unusual operations performed on the gear shaper; the design of a die for the economical production of large quantities of irregular-shaped washers; and some unusual examples of multiple-operation tools of the hollow-mill type.

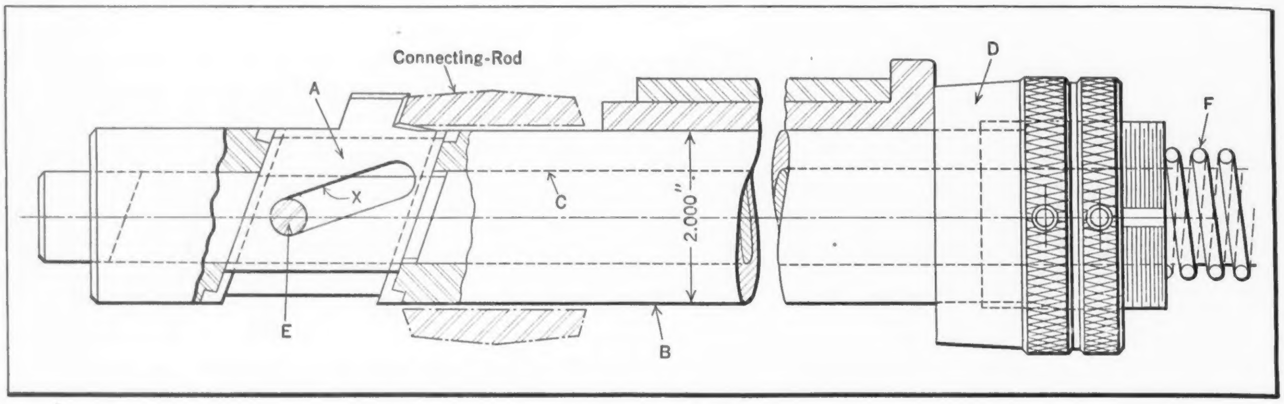


Fig. 1. Special Tool with a Cutter Blade that is Fed Radially for Back-facing Automobile Connecting-rods

Automatic Under-Cutting and Facing Tools

MANY grooving, recessing, facing, and chamfering operations that ordinarily are difficult to handle can be easily performed on both internal and external surfaces by means of a line of tools designed by the Gairing Tool Co., Detroit, Mich., to suit each specific job. The important feature of these tools is that the cutter blades or tool bits are fed automatically into the work, moving either from or toward the axis of the bar that supports them.

The principle on which these tools operate will be understood from Fig. 1, which shows equipment designed for back-facing one side of an automobile connecting-rod boss. The operation is performed with the connecting-rod in the same setting as that in which it is bored and reamed. Cutter blade *A* is held in slots extending through sleeve *B* and bar *C*. The cutter blade has a cam slot *X* which engages a pin *E* that extends across the slot in bar *C*.

In operation, the entire tool is fed through the work and guide bushings until stop-nut *D* comes in contact with the face of one of the guide bushings. This prevents further movement of sleeve *B* and the cutter blade. Thus, as bar *C* continues to advance, the action of pin *E*, riding along cam slot *X*, causes the cutter blade to be fed radially for back-facing the connecting-rod. Obviously, the slot in bar *C* is as much longer than the one in the sleeve as the horizontal length of the cam slot in the cutter blade. The cutter blade is withdrawn into the sleeve by the action of spring *F* when the operator

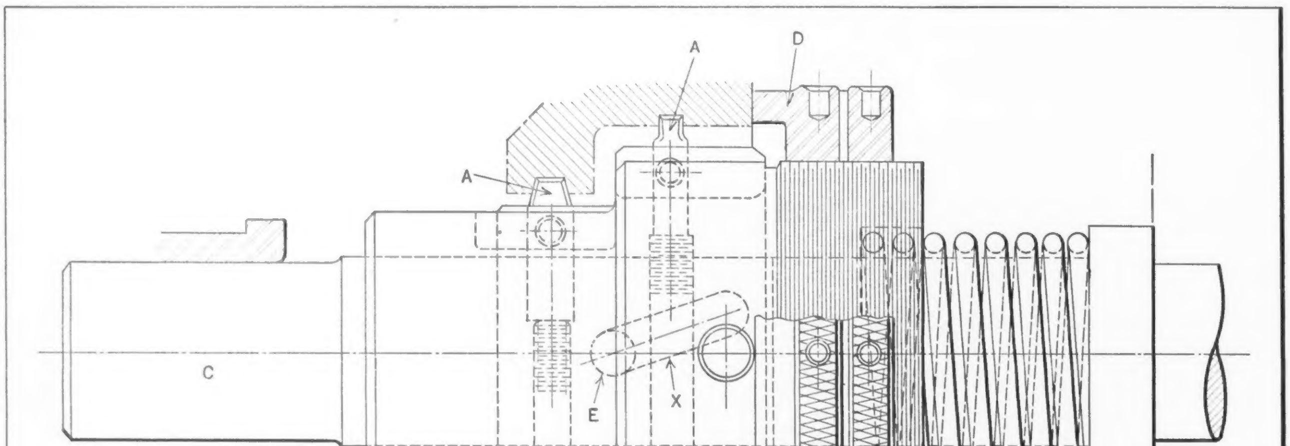


Fig. 2. Tool Bits A Cut Recesses in Counterbored Holes at Accurate Distances from the Face of the Part, as Gaged by Stop-nut D

reverses the movement of bar C, upon the completion of the cut.

Any angular movement of the cutter blade could be obtained by merely inclining the slots in the sleeve and bar to suit. In Figs. 2 and 3, for example, these slots are at right angles to the axis of the supporting bar. Tooling equipment has been designed in which the slots are at an angle of 45 degrees to permit chamfering to be done. The types and locations of the guide bushings vary with conditions.

Two Tool Bits Take Internal Recessing Cuts

The tooling shown in Fig. 2 was designed for simultaneously taking two recessing cuts in a part. The two tool bits A are fed radially after the sleeve B has been entered the required distance into the work. The tool bits are held in a block having a cam slot X that engages pin E in bar C. In this case, stop-nut D comes in contact with the ground face of the work to insure accurate location of the grooves. The distances of the grooves from the work face can be altered by merely adjusting the stop-nut along the thread on the sleeve.

Combined Recessing and Center-Drilling Tools

The design of two tools for simultaneously center-drilling and recessing the trunnions on the opposite ends of an automobile differential spider is illustrated in Fig. 3. Combined drills and countersinks A perform the first mentioned operation, while cutter blades B recess the trunnions preparatory to grinding. When two of the trunnions have been drilled and recessed, the spider is indexed to bring the other two trunnions into position.

In operation, the combined drills and countersinks cut away small-diameter bosses that project from the trunnion ends, but they do not start drilling until the recessing cuts have been completed. When stop-nut D comes in contact with the face of the guide bushing, the recessing tool B of each unit is fed into the work as the cam slot X in the tool-holder engages pin F in bar C.

It will be noted that the cam slot is at an angle with the axis of bar C for about one-half its length, and then extends parallel with the axis. When the position of pin F in relation to the cam slot is as shown, the recessing cut has been completed, and tool B then remains stationary, both longitudinally and radially, as bar C advances to perform the center-drilling and countersinking.

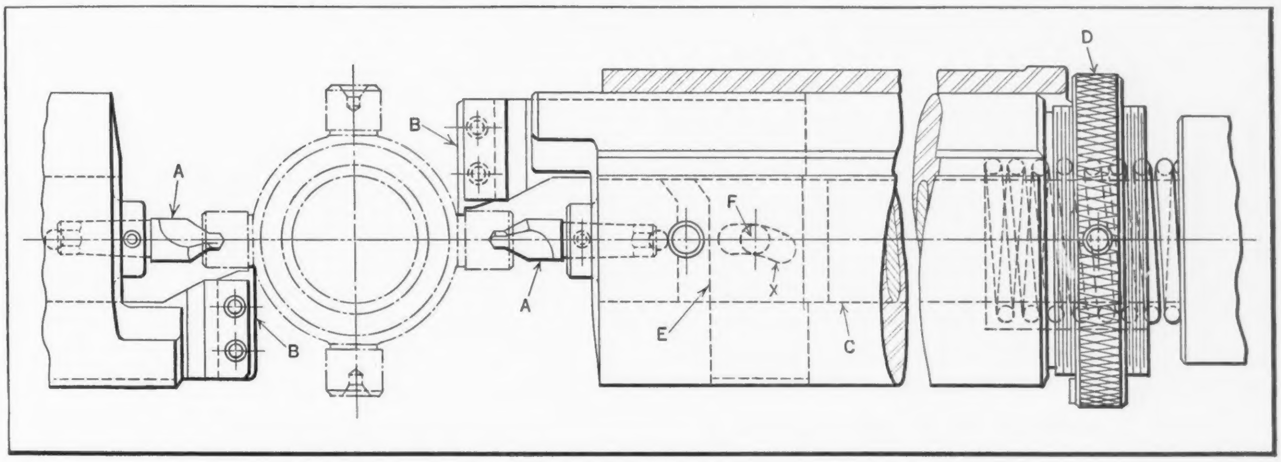


Fig. 3. Tooling Equipment Provided for Simultaneously Drilling, Countersinking, and Recessing Two Trunnions of a Differential Spider

* * *

Prizes Awarded in Gage-Makers' Competition

In the prize competition for gage-makers announced by George Scherr Co., Inc., 128 Lafayette St., New York City, in January MACHINERY, three prizes have been awarded for the answers outlining the best method of making certain types of templets and forming tools. The first prize, a Zeiss indicating micrometer, has been awarded to Byron C. Bronson, Elgin, Ill.; the second prize, a Zeiss optical bevel protractor, to Otto Hill, Detroit, Mich.; and the third prize, a Mauser combination vernier caliper and height gage, to Joseph Rock, Jr., Syracuse, N. Y.

The judges found it a rather difficult task to select, out of the many excellent replies received, those that appeared to present the best methods from the point of view of both accuracy and time required, but they agreed that the three prize winners in one or more particulars scored in the competition.

* * *

The past four years have taught us that there is more to progress than the mere inventing of engineering devices.

Modern Machines of Standard Design Adapted to Special Work

Standard Machine Tools of Up-to-Date Design can be Readily Adapted to Single-Purpose Work by a Few Simple Changes

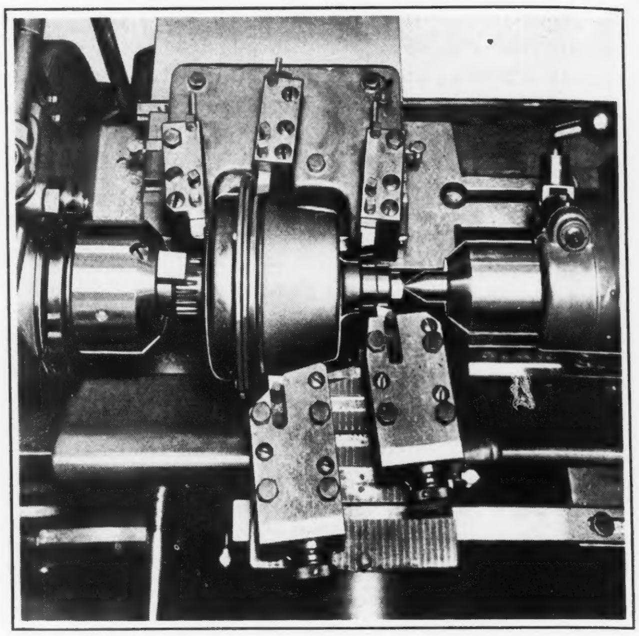


Fig. 1. Assembled Differential Carrier and Tooling by which Five Surfaces are Machined

WHEN there is close cooperation between the purchaser and the manufacturer of certain types of machine tools, it is frequently possible to secure high production on special operations at relatively low cost by making a few simple changes in standard designs. For example, it was desired to turn two diameters and face two shoulders and one end of the assembly shown in Fig. 1. The three facing tools appear above the work-piece and the two turning tools below, an arrangement well suited to the use of the Sundstrand Machine Tool Co.'s 12-inch Stub lathe shown in Fig. 2.

A consultation indicated that a machine without an over-arm, somewhat lower than the standard 12-inch Stub lathe, and having a heavy-duty tailstock adjustable on the bed would be preferable in this instance. As a result, the special machine shown in Fig. 3 was designed and built to meet all these requirements. While this lathe differs considerably in appearance from the standard machine, it is composed entirely of standard and semi-standard units. The term "semi-standard" refers to the low base, bed without over-arm support, and heavy-duty tailstock. These are similar in general design to the

Fig. 2. Standard 12-inch Stub Lathe which by Slight Changes can be Adapted to Arrangements such as Shown in Figs. 3 and 4

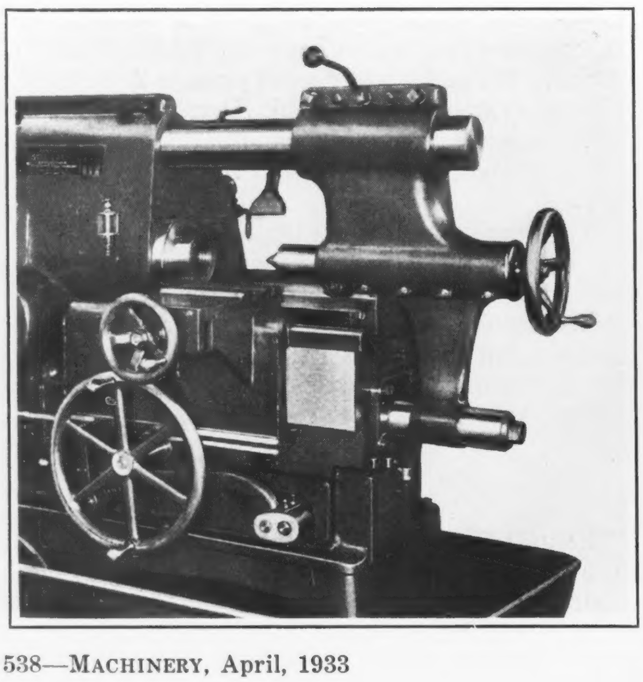
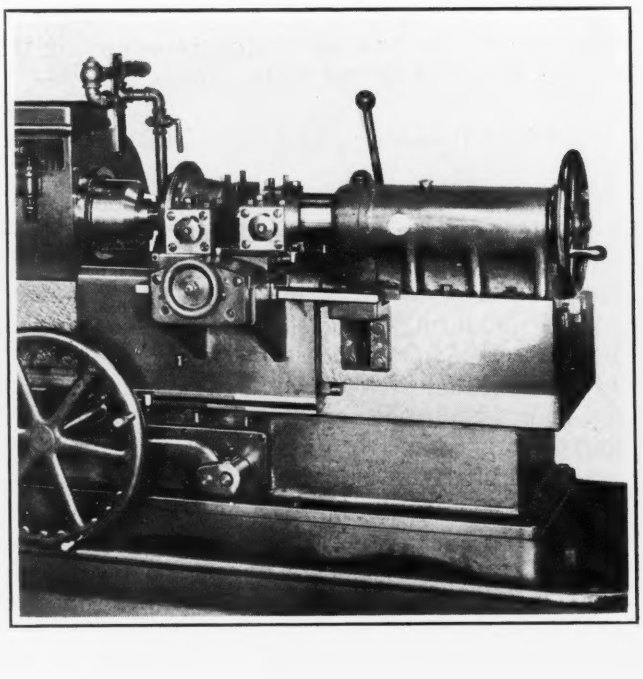


Fig. 3. Special 12-inch Stub Lathe for Turning and Facing Differential Carrier Assemblies Similar to the One Illustrated in Fig. 1



parts previously used, but differ in detail and are made especially for this machine. The spindle mounting and drive (except the motor mounting), front and rear carriages, feed mechanism, and other details are all standard.

While this special lathe was purchased for the work shown, the same machine can be used equally well on a wide variety of other work merely by changing the tooling. Standard Stub lathe attachments can be used, including a third tool-slide, which can be mounted on the headstock in place of the tool tray shown.

Another application, or adaptation, of the lathe shown in Fig. 2 is illustrated in Fig. 4. In this instance, the work-pieces (see Fig. 5) are cast-steel valve plugs, made in eight different sizes, all having the same taper. Machining includes facing both ends, as well as turning the taper. The interrupted cut on the taper caused shocks that quickly broke down ordinary turning equipment. This difficulty was overcome and taper attachments eliminated by mounting the front carriage directly on a bearing machined at the exact angle of the taper to be turned on the valve plugs, with reference to the center line of the spindle. This was readily accomplished by casting a lathe bed with a special carriage bearing and a support for a heavy-duty tailstock. Aside from the bed and tailstock, all parts on the machine are standard. In addition to providing a more durable, accurate, and productive means of turning these plugs, this lathe has the advantage of facing both ends of the plugs simultaneously with the taper-turning operation.

Owing to the angular position of the front carriage bearing, this lathe cannot be applied directly to as wide a variety of work as the one shown in Fig. 3. The possibility of using this machine for other work is remote, but it could easily be adapted to other requirements by its makers, if this should ever become desirable.

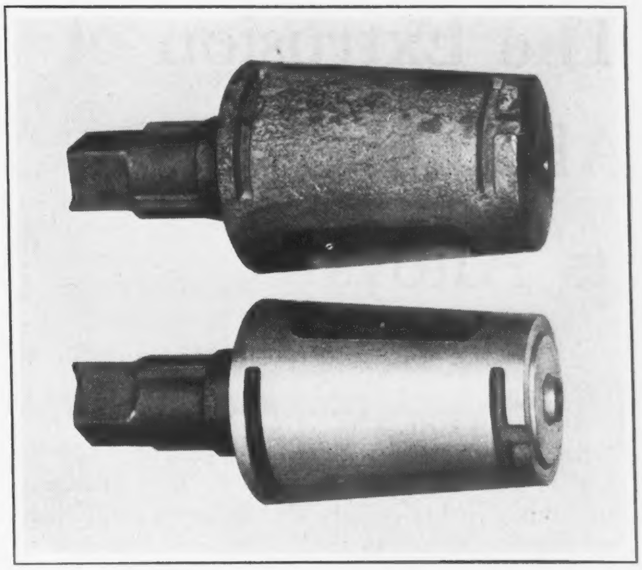


Fig. 5. (Above) Cast-steel Valve Plug in the Rough. (Below) Plug with Taper Turned and Ends Faced by Lathe Shown in Fig. 4

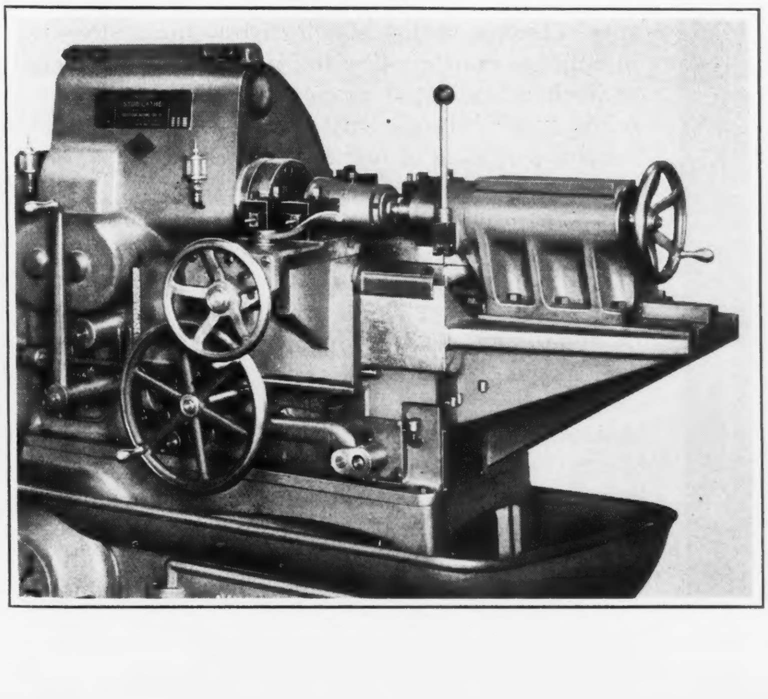


Fig. 4. Stub Lathe that is Equipped with Special Front Carriage Mounting and Tailstock Support

Many other examples of the adaptability of certain types of modern machine tools might be cited. These range all the way from standard machines which can be applied to a wide variety of operations merely by changing their special tooling, to fully automatic machines composed of standard, semi-standard, or special units designed to effect such large savings that they will show a substantial profit long before they can possibly become obsolete. Consultation with the builders of such tools is especially advisable when contemplated operations do not differ greatly from those that can be performed by standard machines and equipment or when it is desired to use special machines, already installed, for other purposes than those for which they were designed originally.

* * *

A booklet entitled "Government Extravagance—the Cause of Price-Cutting" has been published by the Farrel-Birmingham Co., Ansonia, Conn. The booklet was written by N. W. Pickering, president of the company, in collaboration with A. W. Rucker, business consultant. It contains some very definite facts pertaining to profit destruction due to price-cutting, and makes a plea for the reduction of public expenses in order to prevent increases in taxes, with the consequent hardships imposed on business and decrease in purchasing power. While the booklet may be read in a few minutes, it contains a wealth of facts pertaining to the subject it covers.

The Extrusion of Aluminum and its Alloys

IN a paper read before the annual meeting of the American Society of Mechanical Engineers by Robert L. Streeter, consulting engineer of Pittsburgh, Pa., reference was made to the extrusion of aluminum. In his paper, Mr. Streeter pointed out that the first question that arises in regard to the extrusion of aluminum is why this process is used in preference to rolling. There are several answers to this question, each being in itself a logical reason why extrusion is resorted to.

It is hardly conceivable that even a mill devoted entirely to rolling structural shapes would be equipped with rolls for rolling all of the many shapes in their various sizes that are listed in the handbooks as standard products; but customers do not give much thought to the question of available rolls to meet their requirements. No matter what the reasons may be, producers will be offered business for standard shapes for which they have no rolls available, and in the case of aluminum alloys, the way out is to turn to extrusion. It is a much simpler problem to provide extrusion tools for a new section than to provide rolls for a shape mill, as the cost will be less than a tenth of that required for rolls and the time required will be days instead of weeks.

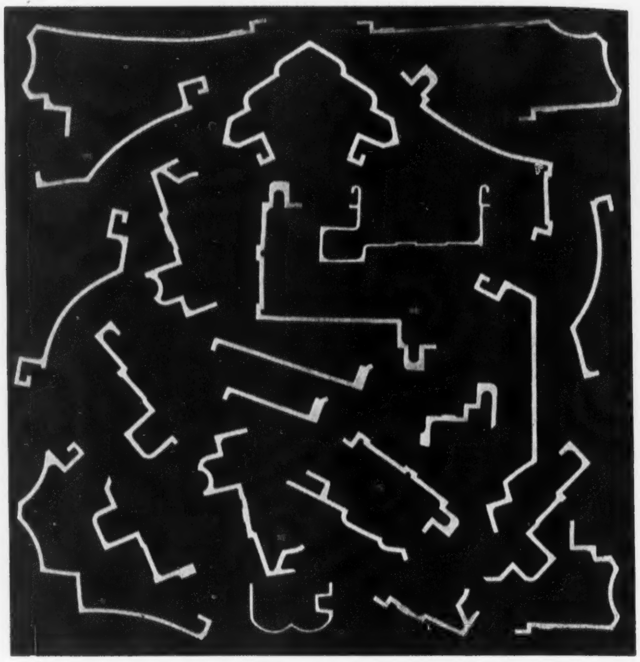
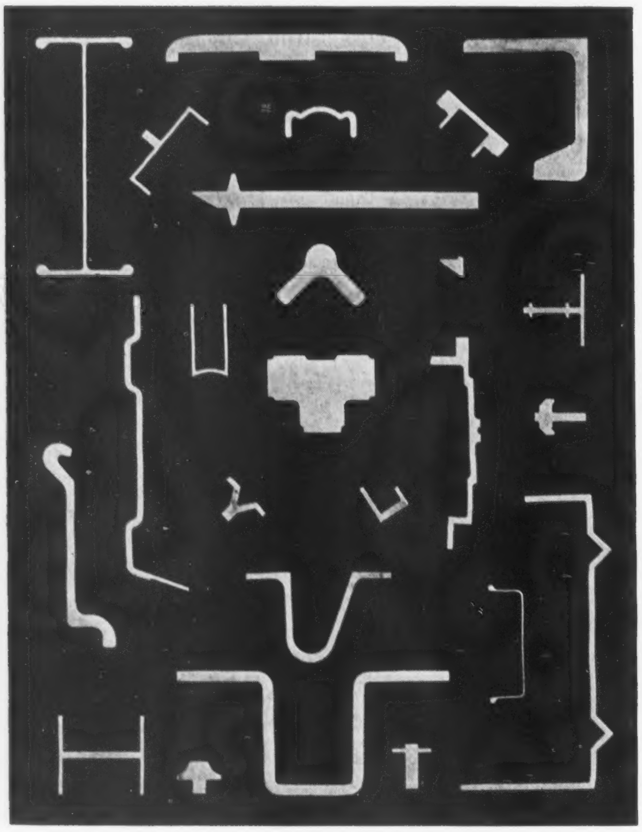


Fig. 1. Examples of Extruded Aluminum Shapes Used for Various Purposes in Architectural Work

Fig. 2. A Variety of Extruded Aluminum Shapes Used for Aircraft and for Bus and Truck Bodies



The question of special shapes is of extreme importance, as in this classification falls a large percentage of the extruded aluminum-alloy business. These special shapes may be odd sizes of so-called standard sections or they may be sections that are nearly standard but are changed just a trifle to suit the designer's necessity or whim. Another class of special shapes is that which covers the sections used in building construction for trim. These are usually of such complicated shape that they could not be rolled even if the quantities involved warranted the purchase of rolls to make them.

Extruding Blooms for Aluminum Tubing

Another important class of extruded products includes those sections on which further work is to be done, such as tube blooms and sheet slabs, as well as rectangular billets. Today practically all drawn aluminum tubing is made from extruded blooms. The principal reason for this is that the bloom that goes on to the draw- or push-bench must be as nearly perfect in finish and dimensions as it is possible to make it. Extrusion seems to be the only practical method of obtaining these results. It is possible to pierce aluminum-alloy billets, and this

practice was followed for several years, but was abandoned for the extrusion process, principally for the reason that the extruded blooms were much more nearly perfect, resulting in lower scrap losses and a better finished product. Extruded blooms can also be made in a larger variety of sizes than is possible on a piercing mill, thus relieving the drawbench of considerable work in reducing the area of the bloom.

It was also common practice until within a very few years to make tubing from sheet circles, using a cupping press and hydraulic push-bench to make the blooms, but this practice has also been discarded for the extrusion press. It is regular procedure today to extrude tube blooms as large as 12 inches outside diameter with 1/2-inch walls, and as small as 1 inch in diameter, with a wall thickness of 1/16 inch.

Extruding Alloys Difficult to Roll

There is still another class of extruded products—those made from alloys that cannot be rolled. Certain aluminum-magnesium alloys are so brittle in the hot cast condition that they break up badly on rolling, but can be extruded without great difficulty. On account of its very desirable physical properties, one of these alloys is used to a considerable extent for drawing fine wire. It has been found to be almost impossible to roll cast ingots of this alloy, so billets about 1 1/2 inches square are extruded, and then put on the rod mill, where they are rolled without great difficulty.

While it is true, as has been stated here, that certain alloys can be extruded with less difficulty than they can be rolled, this is not true of all alloys. Pure aluminum can be rolled and extruded more easily than any of its alloys. Those alloys of the duralumin class, containing about 4 per cent copper, require about three times as much power to roll as pure aluminum.

In color and surface finish, extruded products are quite superior to rolled shapes. This is very important when aluminum is used for decorative purposes, particularly for architectural work. In this work, an alloy containing 5 per cent silicon is used for its desirable properties of color, strength, and resistance to corrosion.

* * *

Socket-Type Set- and Cap-Screws

The Sectional Committee on the Standardization of Bolt, Nut, and Rivet Proportions of the American Standards Association has prepared a proposed standard for socket-type set- and cap-screws. This standard is now being distributed to the industry for criticism and comment before final approval. Those interested may obtain copies by addressing Herman Koester, chairman, Subcommittee No. 9, American Society of Mechanical Engineers, 29 W. 39th St., New York City. Suggestions and comments are solicited by the committee.

Applications of the Pendulum Hardness Tester

The Herbert pendulum hardness tester is particularly applicable for measuring the hardness of materials that cannot advantageously be subjected to the application of hardness testing by the Brinell or scleroscope methods. As shown in the accompanying illustration, the pendulum device is used in the research department of the Westinghouse Electric & Mfg. Co. for determining the hardness of beryllium. The device is also used for testing the hardness of thin sheets of metal, very brittle metals, and casehardened metals.

A small steel ball, 0.040 inch in diameter, supports the heavy pendulum on the test specimen. The ball sinks deeper into soft specimens being tested than into harder ones. This lessens the amount of the swing of the pendulum, but increases the time required for the swing. An air bubble in the curved tube at the top of the pendulum indicates on the scale above the tube the extent of the pendulum's swing, and this, in turn, serves as a measure of the hardness of the specimen.

Using a Herbert Pendulum Hardness Tester for Measuring the Hardness of Beryllium in the Westinghouse Laboratory

* * *

The filament of a 40-watt Mazda lamp is made of a tungsten wire so fine that it takes over thirty miles of it to weigh a pound. Less than 0.001 ounce of this wire is required for the filament of a lamp.

NEW TRADE  LITERATURE

Recent Publications on Machine Shop Equipment, Unit Parts, and Materials. Copies Can be Obtained by Writing Directly to the Manufacturer.

DIE SETS. E. A. Baumbach Mfg. Co., 1810 S. Kilbourn Ave., Chicago, Ill. Catalogue No. 33 (209 pages, 9 by 12 inches), covering the complete line of standardized die sets made by this company, including semi-steel and drop-forged steel die sets. The catalogue also contains data on plain die-shoes and punch-holders, bolster plates, dowel-pins, die-shoe clamps, leader pins, bushings, die springs, stripper bolts, and screws of the socket-head type. Complete details, including dimensions and prices, are given concerning the three types of die sets made, and the book is provided with a thumb index for convenient reference.

LATHES. South Bend Lathe Works, South Bend, Ind. General catalogue No. 93, describing the entire line of South Bend lathes, in sizes from 8 to 24 inches swing. The book also illustrates and describes the many attachments with which a screw-cutting lathe can be fitted. Ninety-six different sizes and types of lathes are shown. In addition to the regular line of lathes for the machine shop and maintenance department, there are special tool-room lathes, gap-bed lathes, brake-drum lathes, and metric lathes. Additional information covers roll-grinding set-ups, wood-turning for patternmaking, and mountings for special work.

CENTRODE DEVICE AND OVAL CHUCK. Monarch Machine Tool Co., Sidney, Ohio. Catalogue illustrating and describing the Monarch centrode device by means of which it is possible to turn, bore, and face shapes other than round. The catalogue also illustrates and describes the Monarch oval chuck, which is applicable to Monarch lathes and Monarch-Keller form-turning machines for machining oval work. Different uses of Monarch-Keller automatic form-turning machines are shown.

ELECTRICAL EQUIPMENT. General Electric Co., Schenectady, N.Y. Booklet entitled "Modernization Pays," containing examples of actual cases where savings have been effected by the use of modern electric equipment. The examples presented have been selected from a large number of installations in a wide variety of industries all over the United States.

GEARMOTORS. Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa. Leaflet 20562, describing the complete line of Westinghouse Gearmotors and illustrating a number of applications. Leaflet 20520-A, on Westinghouse multi-speed Gearmotors. Tables of horsepower ratings and speeds are included.

MARKING AND NUMBERING DEVICES. Wm. A. Force & Co., Inc., 105 North St., New York City. Catalogue 108, listing typical marking equipment for indenting and embossing made by this concern. In addition to the examples illustrated, the firm is prepared to build any special marking or numbering device required.

WELDING AND CUTTING EQUIPMENT. Smith Welding Equipment Corporation, Minneapolis, Minn. Catalogue for 1933, covering the oxy-acetylene welding and cutting equipment made by this concern, including a complete line of oxy-acetylene welding and cutting torches, regulators, and generators.

COLD-FINISHED STEEL. Keystone Drawn Steel Co., Spring City, Pa. Keystone Cold-finished Steel Handbook, and Catalogue No. 107, containing data on cold-finished steel bars and shafting, including processes of manufacture, physical properties, uses, and S A E specifications.

ELASTIC STOP-NUTS. Elastic Stop Division of the A. G. A. Co., Elizabeth, N. J. Bulletin illustrating typical applications of elastic stop-nuts in various industries. The catalogue also contains tables of dimensions, weight, and prices of standard steel, brass, special, and aircraft nuts.

MECHANICAL RUBBER GOODS. Diamond Rubber Co., Inc., Akron, Ohio, has just issued a Buyers' Guide to Mechanical Rubber Goods, containing information on rubber goods for industrial uses, arranged in convenient form. The book also lists standard stock sizes and prices.

BOILER TUBING. Steel & Tubes, Inc., 224 E. 131st St., Cleveland, Ohio. Leaflet descriptive of electric resistance welded boiler tubes known as "Electrunite" boiler tubes, which are suitable for use in fire-tube or water-tube boilers requiring either straight or bent tubes.

LIQUID GLASS COATING. Skybryte Co., 1919 E. 19th St., Cleveland, Ohio. Circular descriptive of Skyco "NoGlare," a liquid glass coating intended to be applied to the windows of industrial buildings, for the purpose of eliminating the heat and glare of direct sunlight.

ELECTRIC FURNACES. H. O. Swoboda, Inc., 3530 Forbes St., Oakland Station, Pittsburgh, Pa. Bulletin 280, illustrating and describing Falcon continuous electric furnaces for hardening, tempering, and annealing strip metal and wire products.

FINISHING WAX. Halowax Corporation, Division of Bakelite Corporation, 247 Park Ave., New York City. Circular descriptive of "Halowax," a waxlike substance used for finishing and protecting metal, wood, and other surfaces.

STAINLESS STEEL. American Stainless Steel Co., Commonwealth Bldg., Pittsburgh, Pa. Pamphlet entitled "Forward with Stainless," illustrating the wide variety of uses for which stainless steel is adapted.

POWER-TRANSMISSION EQUIPMENT. Chain Belt Co., Milwaukee, Wis. Circular containing data on Rex chains, Z-metal, set collets, bearings, sprockets, traction wheels, idlers, conveyors, pumps, and castings.

Shop Equipment News

Machine Tools, Unit Mechanisms, Machine Parts and Material-Handling Appliances Recently Placed on the Market

Plastic-Products Molding Presses

Two hydraulic presses built by the French Oil Mill Machinery Co., Piqua, Ohio, for molding parts from synthetic plastics are shown in the illustrations. The machine illustrated in Fig. 1 has an auxiliary tilting head to which the top die is attached. This head is supported by short arms centered on the rear columns and by long arms centered on top of and toward the front of the press cylinder. Each arm has a cam slot in which operates a roller fastened to the side of the ram platen. As the platen moves upward into the pressing position, the rollers pull the long arms forward, causing the tilting head to move through an arc of 90 degrees. It comes to rest in a horizontal plane directly against the stationary press head. This motion is accomplished without auxiliary hydraulic cylinders.

Full pressure is thus taken against the main head of the press, no part of the tilting mechanism being required to carry any of the pressing load. When the operation is completed, the ram recedes and the head that carries the top die automatically tilts back into the position shown. The motion of the tilting head is smooth, though rapid.

One advantage of this type of press is that the die members can always be inspected with ease, thus promoting cleanliness and the molding of accurate parts. Another advantage is the convenience afforded in handling work requiring metal inserts in the top die. Without a tilting die, either the die must be removed from the press for putting such inserts in place or else the inserts must be located in an inverted die, which is a slow process. The dies shown in the machine in Fig. 1 are for molding the continental type of telephone set.

Presses of this construction can be provided with knock-outs

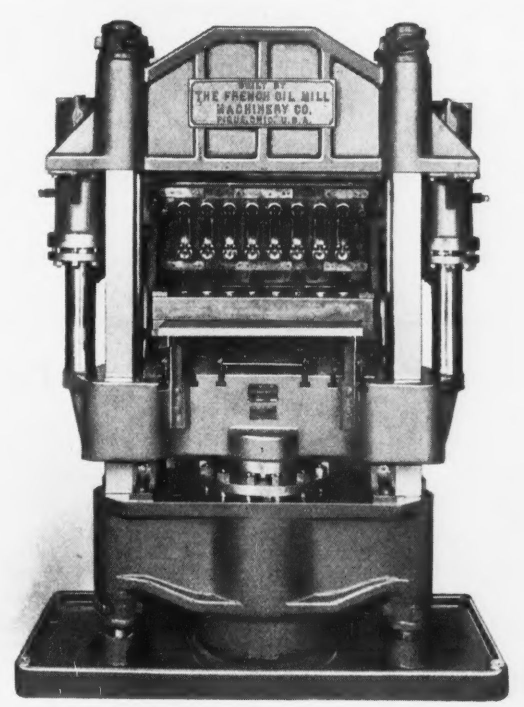


Fig. 1. Tilting Die Type of Plastic-Products Molding Press Built by the French Oil Mill Machinery Co.

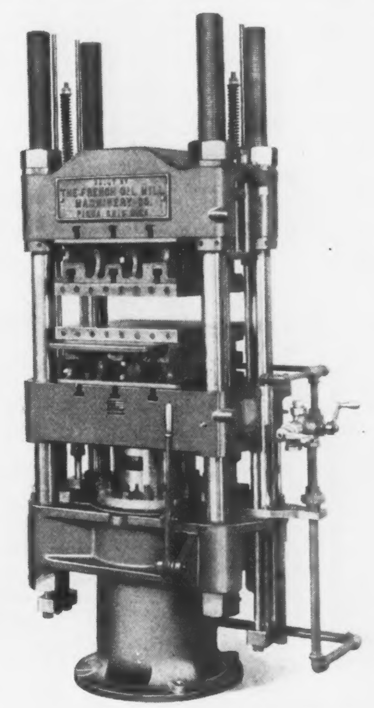


Fig. 2. Semi-automatic Press for Operations in which the Molds are Placed on Grids

for ejecting the work from both the top and bottom die members. These knock-outs can be operated manually, mechanically, or hydraulically.

Fig. 2 illustrates a semi-automatic molding press of the type usually furnished with grids on which the molds are mounted. As this press returns to the open position, a lower knock-out is operated to eject the parts from the molds. This ejecting mechanism is released by pulling the lever at the front of the press, which causes the molds to open for reloading. The return motion of the platen also operates a top knock-out for ejecting parts from the top die.

Trombetta High-Speed Solenoids

High-speed solenoids that will operate successfully up to as many as 200 times a minute have been developed by Panfilo Trombetta and are now being manufactured by the Wrought Washer Mfg. Co., 2100 S. Bay St., Milwaukee, Wis. These solenoids will operate on either alternating or direct current of any voltage up to 2300. They are intended for many applications in which a relatively small force must act through a relatively small distance, as for example, a force of 10 or 20 pounds through a distance up to 4 inches. These solenoids are made in various standard sizes.

Electric Gage which Checks Nine Diameters at One Time

"Electriclimit" Gage for Several Diameters

An electric gage that checks a number of diameters at one time has been developed by the Gage Division of the Pratt & Whitney Co., Hartford, Conn. The illustration shows this gage arranged for checking nine diameters of an automobile piston—five outside and four groove diameters.

The checking is done by means of electric contacts which are arranged to gage the desired surfaces as the piston is slid through the fixture. When the piston has been machined within specified limits, no lights appear on the indicating board, but if any dimension is over size, a green light flashes on, and if it is under size, a red light appears.

In the plant where this gage has been in continuous use for several weeks, 864 pistons are now gaged per hour, as against 288 by the previous inspection method—a ratio of 3 to 1. It is claimed that there has been a definite increase in the uniformity and quality of the inspection, even though a less skilled inspector is used than formerly. This type of gage can be applied to many pieces on which one or several dimensions are to be inspected.

LeBlond "Oil Country" and Carbide Tool Lathes

A heavy-duty lathe designed especially for the type of work most frequently encountered in the oil fields has been brought out by the R. K. LeBlond Machine Tool Co., Cincinnati, Ohio. The new machine is shown in Fig. 1. The twelve-speed headstock provided on this machine has a spindle reverse, selective speed change, continuous forced circulation of filtered oil, and anti-friction bearings for the intermediate shafts. The spindle has a bore 10 1/4 inches in diameter. The final drive to the spindle is through helical gears.

The feed-box has an exceptionally wide range of feeds to give all the leads commonly re-

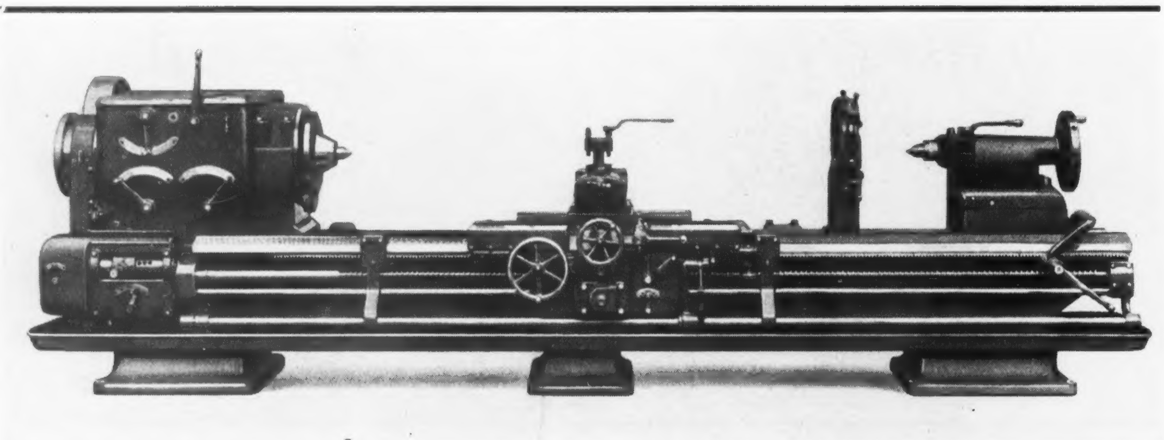


Fig. 1. LeBlond Heavy-duty Lathe Designed Particularly to Meet the Requirements of the Oil Fields

quired without the use of pick-off gears. The positive clutch which engages the feed is so designed that the teeth must either be fully engaged or fully disengaged. This construction permits the operator to disengage the clutch readily under the heaviest cut without the carriage dragging past the desired stopping position.

The taper attachment is especially constructed for heavy work. It has a capacity for 6 1/2 inches per foot for 18 inches or 4 3/4 inches per foot for 30 inches. A power traverse to the carriage reduces the labor and time consumed when long shafts are being turned. Supports are provided for the lead-screw and feed-rod at the front of the bed and for the power traverse screw at the rear of the bed.

The 11-inch high-speed motor-head lathe shown in Fig. 2 has been designed to permit the use of tungsten- and tantalum-carbide tools to their full extent. The machine is particularly suitable for turning small shafts and such materials as bronze, babbitt, molded plastic products, aluminum, and white metal. The multi-speed motor armature is mounted on the spindle, and the spindle revolves in precision ball bearings. End thrust is taken by the front bearing, while the rear bearing floats lengthwise. This construction prevents the setting up of strains due to expansion. The spindle can be brought up to the high speed of 3600 revolutions per minute and stopped five times a minute.

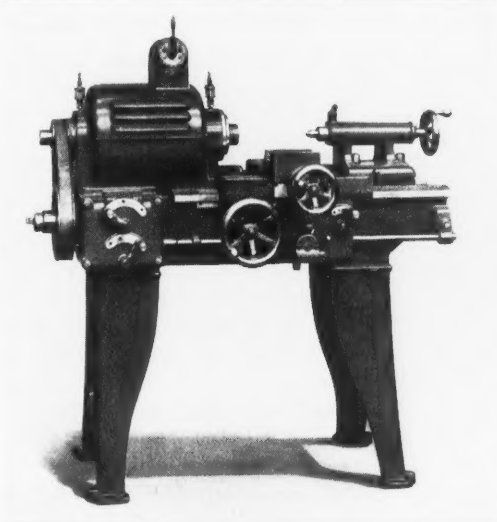


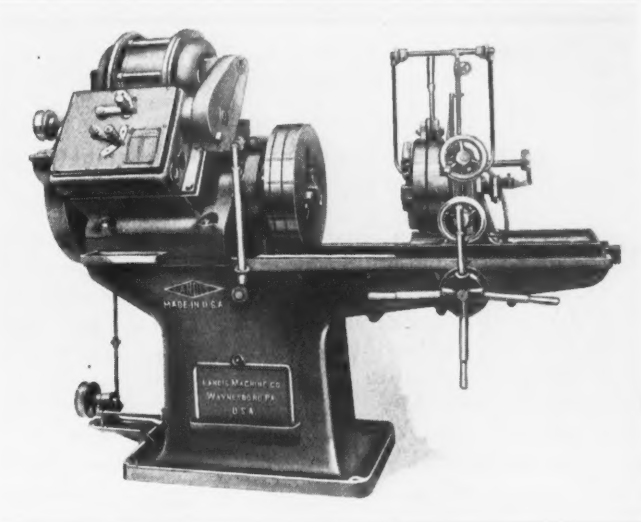
Fig. 2. "Rapid Production" Lathe Designed for Carbide Cutting Tools

Selective-Speed Gear-Box for Landis Threading Machines

The motor-driven 2-inch pipe threading and cutting machine, 2-inch pipe and nipple threading machine, and 2- and 2 1/2-inch bolt threading machines built by the Landis Machine Co., Inc., Waynesboro, Pa., now have an eight-speed gear-box.

Heretofore, motor-driven machines of the sizes and types mentioned employed a tumbler-type gear-box which gave five speeds. However, the manufacturer has found that a wider speed range is desirable, due to the variation in the machineability of the materials used in making pipe and bolts. The new gear-box gives both slower and faster speeds than those heretofore considered standard.

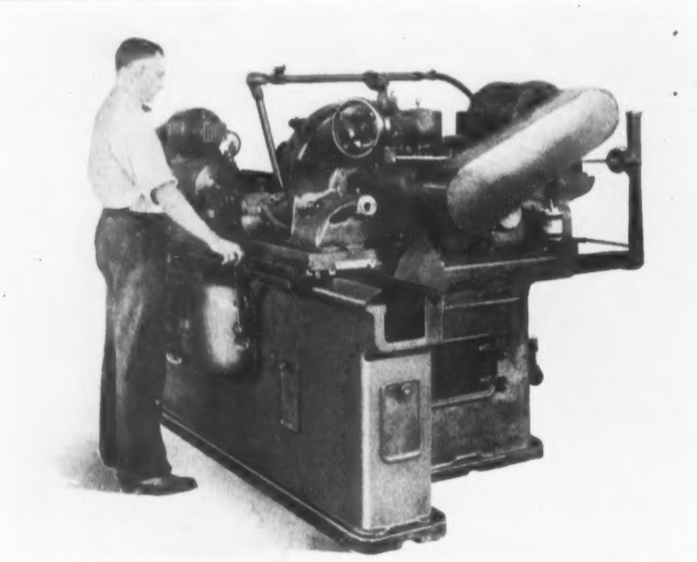
In the illustration, this selective-speed gear-box is shown applied to the 2-inch pipe threading and cutting machine. Since this gear-box is self-contained, it is readily applicable to Landis machines already in service.



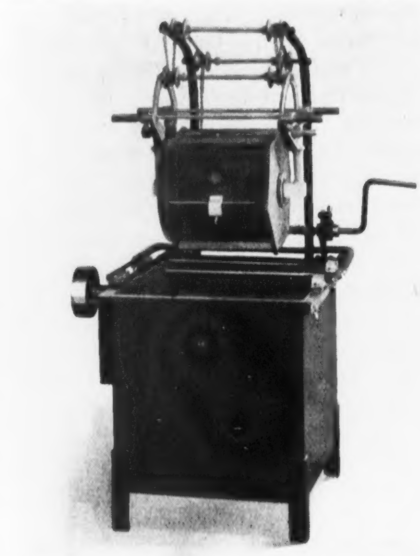
Eight-speed Gear-box Applied to a Landis Pipe Threading and Cutting Machine

Recorder-Controller for Testing Machines

An instrument has recently been developed by the Baldwin-Southwark Corporation, Philadelphia, Pa., for recording the loads applied in testing materials in Southwark-Emery machines, which produce and measure the load hydraulically. The instrument consists of an autographic stress-strain recorder which produces a graph up to or through the failure of metal, wood, or other materials. In addition, the application of the load can be controlled through the instrument, so as to effect a constant rate of strain increment, a constant rate of load increase, and a load maintenance at a constant value. This automatic recorder-controller in no way limits manual control.



Landis Plain Hydraulic Grinder Having All Controls within Easy Reach of the Operator



Small Plating Machine with Welded Steel Tank and Formica Cylinder

Landis 10-Inch Type C Plain Hydraulic Grinding Machine

A Type C plain hydraulic grinding machine has been brought out by the Landis Tool Co., Waynesboro, Pa., in a 10-inch size to supplement the 6-inch machine described in July, 1931, MACHINERY, page 877. Typical jobs for the new machine include such work as motor armatures, shafting, and camshaft line bearings. It is particularly recommended by the manufacturer for grinding the line bearings of practically all crankshafts, with the exception of very large, heavy ones.

The new machine has the same general characteristics as the smaller one, although the proportions are, of course, heavier. It is self-contained, and ease of operation is a main feature. All controls are grouped within easy reach of the operator, so that no stretching, stooping, or straining is required.

The machine has a high degree of flexibility, enabling a large variety of parts to be ground with the standard equipment. In addition, a large number of special attachments are available which further increase the range. The wheel base or the headstock can be set at an angle, and in cases where the nature of the work requires it, crank heads can be furnished.

The machine can be operated fully automatically or semi-automatically. The hydraulic straight-in feed mechanism is another feature. Formed-wheel grinding and multiple-wheel grinding can be performed. The hydraulic table traversing mechanism is of the twin-cylinder type. Table speeds ranging from 6 to 240 inches per minute are possible. An automatic hydraulic wheel feed which functions at each reversal of the table can be supplied.

Needle Files with Knurled Handles

Needle files with knurled handles or tangs, in place of the previous smooth, round handle or tang, are being placed on the market by the American Swiss File & Tool Co., 410-416 Trumbull St., Elizabeth, N. J. The knurling on the handle prevents slippage. A firm grip is possible without cramping the fingers or the hand of the user. These needle files are made in all the regular shapes and sizes.

Udylite Small Plating Machine

A small plating machine designated "Maximus Junior" has been placed on the market by the Udylite Process Co., Detroit, Mich., for use in plants having many small rush jobs or insufficient work for larger plating machines. The tank is made of heavy welded steel construction, and the removable cylinder in which the parts are plated is of perforated Formica. A hand hoist and drain board are provided for raising the cylinder and conveniently emptying the load.

The unit is furnished with either a belt drive or a direct motor drive. The tank is 28 inches long by 21 inches wide by 22 inches deep, while the cylinder is 12 inches in diameter by 12 inches long. The equipment weighs about 180 pounds.

Bonney Screwdrivers with Transparent Handles

Handles of a tough, amber-colored, transparent composition that is a non-conductor of electricity are provided on a line of screwdrivers just added to the products of the Bonney Forge &

Tool Works, Allentown, Pa. The handles are virtually unbreakable and are fluted to provide a secure grip.

The screwdriver blades are solid one-piece forgings that are heat-treated throughout their length, ground, and polished. The tips are taper-ground to insure a non-slip fit in the screw slots. These screwdrivers are made in five styles and thirteen sizes.

Eclipse Micro-Justable Holder

An instant micrometer adjustment for length and a constant positive lock in any position are the principal features of an adjustable-length holder, which has just been produced by the Eclipse Counterbore Co., Detroit, Mich., for end-cutting tools, reamers, taps, drills, etc. Any change in holder length from 0.001 to 1 1/4 inches is instantly accomplished by raising the knurled lock sleeve *C* (see illustration) by hand, turning the adjusting sleeve *B*, and then again lowering the lock sleeve. A pawl located under the sleeve engages serrations on the driving shank and thus locks the holder and prevents changes in setting from taking place.

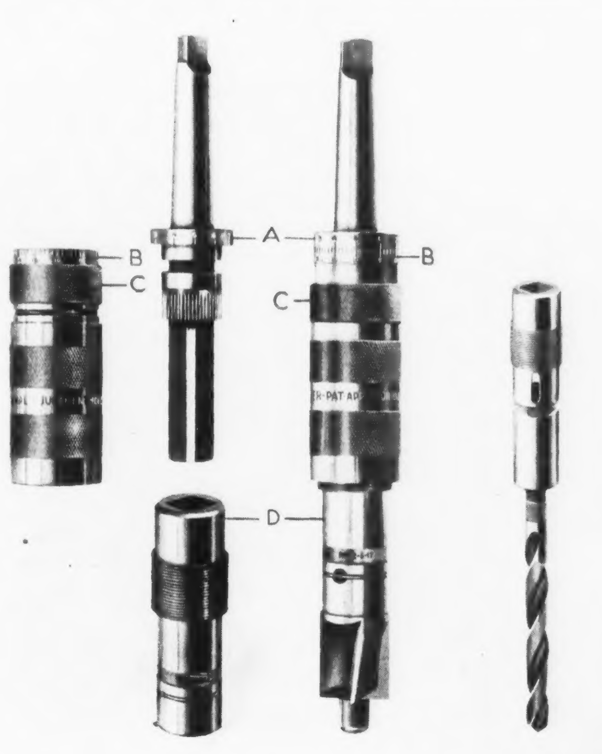
The square stem provides a sturdy driving means in the broached hole of the cutter-holding socket *D*, while the circular ground corners of the stem provide accurate alignment in a ground bearing of the socket. Thrust is taken by the sleeve *B* bearing against the flange *A* of the driving shank.

Only the socket of this holder is changed in adapting it for use with different types of tool shanks. At the extreme right is shown a socket with the lower end made to permit the use of twist drills.

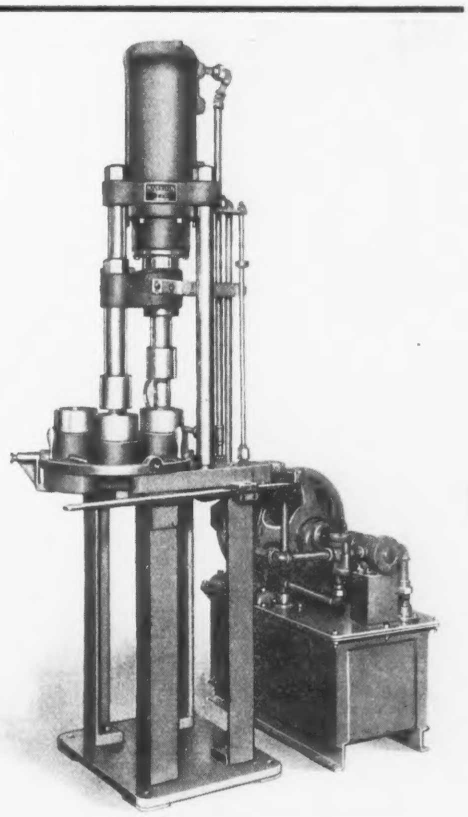
Hannifin Three-Column Hydraulic Press

A twenty-ton hydraulic press of the three-column type illustrated has just been developed by the Hannifin Mfg. Co., 621 S. Kolmar Ave., Chicago, Ill., for a variety of operations. In machine shops, the equipment is suitable for various forming and assembling operations. Since the ram movement is reversed automatically when a predetermined pressure has been reached, the machine is particularly suitable for assembling operations in which the parts are made of material that might become damaged or distorted if excessive pressure were applied. The machine can be used for such operations as pressing shafts into small gears, or bushings into metal castings or molded plastic products.

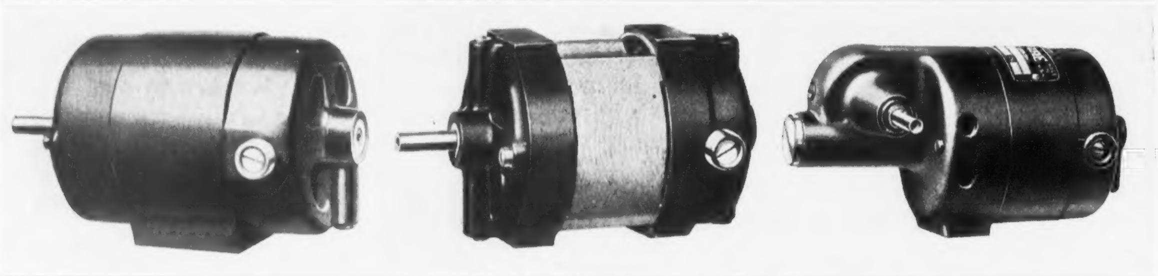
The reversal of the press is



Eclipse Tool-holder with Instant Micrometer Length Adjustment and Positive Lock



Hannifin Three-column Press with Indexing Table



Three Small Universal Motors Recently Brought out by the Dumore Co.

adjustable over a wide range. The automatic control permits the operator to start the press through its complete cycle by moving one lever. However, the operator can stop or reverse the press at any point. Two-column, four-column, and open-gap hydraulic presses are also built by this concern.

Three Dumore Motors

A K-3 series universal motor recently brought out by the Dumore Co., Racine, Wis., is shown at the left in the illustration. The manufacturer states that this motor is designed for applications requiring better than average performance. It has a 1/6 horsepower rating at 5500 revolutions per minute for thirty minutes, or a 1/8 horsepower rating at 6500 revolutions per minute for continuous duty.

In the middle of the illustration is shown a J-3 motor, which is of the same design as the K-3 model, except for the housing and the provisions for ventilation. Both these motors are especially adapted for operating such electrical tools as portable drills, saws, routers, grooving machines, and sanders, or such appliances as vacuum cleaners, floor polishers, and portable washing machines.

The EEXQ motor shown at the right is a small slow-speed universal motor with a single worm-gear reduction. The full-load speed of this motor is 8000 revolutions per minute. Gear ratios of 15 to 1, 30 to 1, and 40 to 1 are available as standard, which means that shaft speeds of from 200 to 750 revolutions per minute are possible.

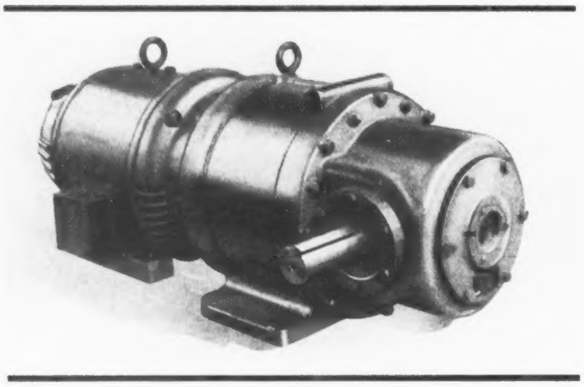
Morrison Right-Angle Motorized Speed Reducer

A motorized speed-reducing transmission in which the output shaft is at right angles to the motor shaft has been added to the products of the Morrison Machine Co., 1171-1225 Madison Ave., Paterson, N. J. A feature of this transmission is that by applying only a wrench, the right-angle unit can be swiveled with respect to the main housing for positioning the output shaft horizontally in either direction, vertically upward or downward, or in any 45-degree position above or below the horizontal.

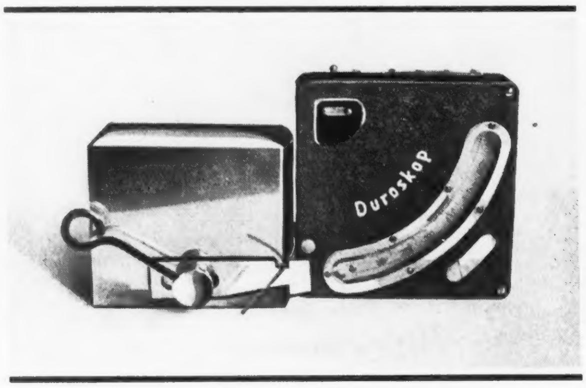
As in the case of the speed-reducing transmission described in March MACHINERY on page 493, this model is available in an almost infinite number of ratios and in a large range of sizes. The particular reducer illustrated has a ratio of 27 to 1.

Duroskop for Testing Hardness of Wire

A portable hardness testing instrument called the "Duroskop" was described in December, 1931, MACHINERY, page 314, at the time that it was placed on the American market by the R. Y. Ferner Co., Investment Bldg., Washington, D. C. The original



Morrison Speed Reducer with Adjustable Right-angle Output Shaft



Wire and Other Small Materials Can be Tested for Hardness with This Special Duroskop

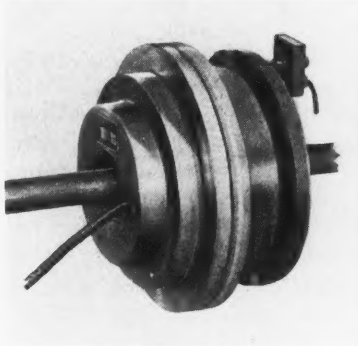
instrument was intended for general hardness testing. A special model, as here illustrated, has now been brought out by the concern for testing the hardness of wire and other cylindrical material of small size.

In the Duroscop, hardness is measured by the angle of rebound of a falling pendulum. For testing wires, the usual spherical anvil on the hammer-head of the pendulum is replaced by a cylindrical anvil, the axis of which is parallel to the pendulum rod. The side of the cylinder strikes across the wire being tested when the latter is held in a horizontal position.

Rapid routine tests of wire are possible, even with the wire in motion. For such tests, the wire is held against the curved face of a hardened steel block, as illustrated, at the same level as the point at which the pendulum hammer-head strikes through the edge of the Duroskop case.

Stearns Combination Magnetic Clutch and Brake Unit

A combined magnetic clutch and brake recently developed by the Magnetic Mfg. Co., Milwaukee, Wis., for specific application to the motor-driven spindles of machine tools is shown in the accompanying illustration. This unit eliminates belt shifting and manual stopping, while providing an accurate control.



Magnetic Clutch and Brake Designed for Machine Tool Use

The clutch is 10 inches in diameter and has a torque rating of 1000 inch-pounds. It is mounted inside a driven sheave which idles on the shaft. The magnetic brake is 8 inches in diameter and has a torque rating of 350 inch-pounds. It is mounted in a fixed position in the housing of the spindle gear-box. The armature is used both for clutching and braking.

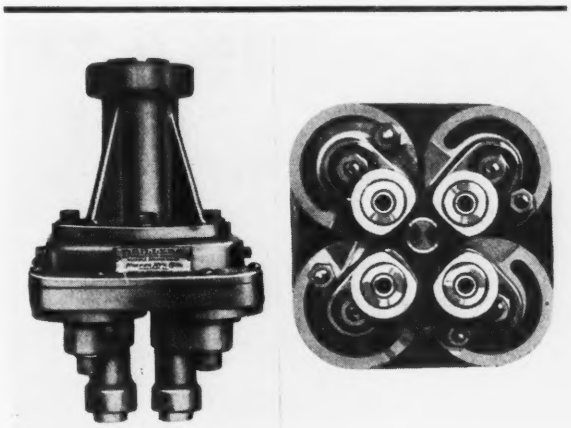
Hoefer "Solid Adjustable" Drill Heads

Drill heads designed with a view to reducing drilling costs on small-lot jobs have been brought out by the Hoefer Mfg. Co., Inc., Freeport, Ill., for operations in which the holes are arranged in circles. These "solid adjustable" heads can be equipped with various adapters to permit their use on drilling, milling, boring, and other machines.

The entire mechanism of the heads is enclosed in an oil-tight, dirt-resisting body. The heads are built regularly with from two to eight spindles. Power is delivered from a main driver gear to as many idlers as there are spindles in the head. The lower end of each idler enters a spindle bracket fitted snugly to the bottom of the head. From each individual idler, power is delivered to the spindle located in the same bracket. The bracket pivots around the idler for adjustment purposes. A double clamping means insures rigid locking of the spindles.

Beaver Pipe and Tube Tools

Among a number of new products recently added to the line of Beaver pipe tools made by the Borden Co., Warren, Ohio, are the power adapter shown in Fig. 1, the No. 12-R ratchet type die-stock illustrated in Fig. 2, and the No. 100 tubing cutter. The power adapter can be supplied with die-heads for cutting pipe threads from 1/4 inch to 2 inches, and for threading rods,



Hoefer Drill Heads Designed Especially for Small-lot Jobs

Fig. 1. Beaver Power Adapter for Cutting Threads on Pipe and Rods

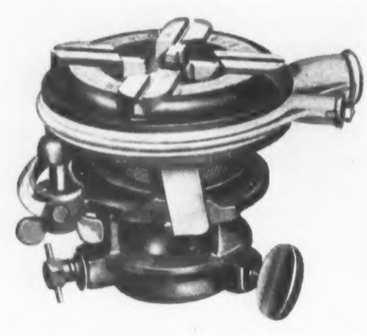


Fig. 2. Beaver Self-contained Ratchet Die-stock

staybolts, etc., from 1/4 to 1 1/2 inches. The use of a 5/8-inch heavy-duty electric drill is recommended by the manufacturer for driving the outfit.

The 12-R ratchet die-stock is fully adjustable to permit cutting standard, over-size, or under-size threads on steel, iron, cast-iron, brass, or copper pipe. The ratchet drive ring is on the die-head, which is said to insure easy pulling. This die-stock weighs about 16 pounds.

The No. 100 tubing cutter is intended for cutting copper tubing from 1/8 to 3/4 inch, with clean, square ends. Other recent additions to the Beaver line include a Model A pipe machine, square-end sawing vise, threaders and cutters, bolt die-heads for the No. 3 ratchet die-stock, and threading oil.

Allen Drilling Machines

A hydraulically fed machine designed for drilling small deep holes in steps is the latest development of the Charles G. Allen Co., Barre, Mass. In operation, the drills are advanced at a high speed to the work, at which point their advance is automatically changed to a fine feed. After drilling to a predetermined depth, the drills are completely withdrawn from the work. They are returned at high speed to the point previously drilled, when the fine feed is again automatically engaged. After the holes have been drilled to their full depth, the spindle slide returns to its highest position, where it remains while the operator reloads the fixture. Each cycle is started by pulling the pendent ball handle.

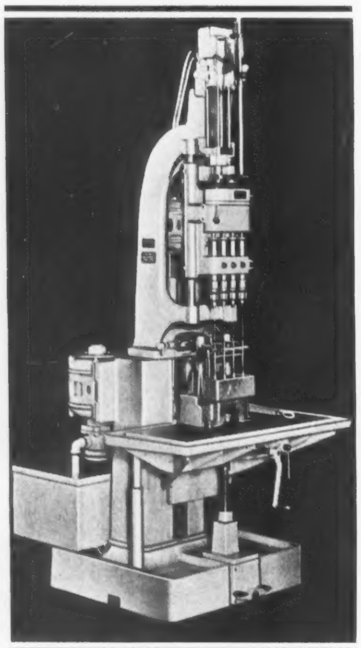


Fig. 1. Allen Step Type Drilling Machine for Deep Holes

This step drilling machine is shown in Fig. 1 equipped with a four-spindle unit. Two or more units can be mounted on one base for drilling holes up to 1/4 inch in diameter to a maximum depth of 8 inches. The spacing of the spindles, as well as the number, can be varied to suit requirements. Spindle speeds from 750 to 3000 revolutions per minute can be obtained. The spindle driving motor is mounted directly on the slide. The feed per revolution of the drill and the depth of step are readily adjustable.

Further developments have also recently been made in the No. 3 ball-bearing drilling machine manufactured by this concern, which was described in November, 1931, MACHINERY, page 229. The improved machine is shown in Fig. 2. Important differences between the latest model and the former machine include an individual direct-connected motor drive to the spindles through multiple V-belts; a reversing motor for the left-hand spindle to facilitate tapping operations; and flanged quills for the direct connection of multiple-spindle drill heads.

The connected cam feeds are provided with cams designed to meet requirements. Both cams are operated by one feed mechanism. Control of the camshaft is obtained through a foot-operated index-table locking pin. The camshaft stops automatically at the end of each cycle. This machine can be readily adapted to various production jobs or it can be changed over to a standard drilling machine.

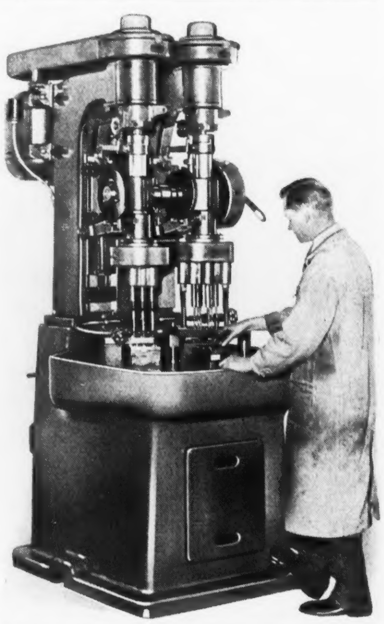


Fig. 2. Allen Ball-bearing Drilling Machine of Improved Design

Westinghouse Thermostat-Protected Motors

A completely self-protecting motor that cannot burn out and yet carries overloads as long as the motor itself is not in danger is being introduced to the trade by the Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa. The advantages mentioned are

Westinghouse Motor which Cannot Burn Out

obtained by the use of a small disk-type thermostat, mounted on the motor frame, which opens the circuit when the motor gets too hot and connects it again after it has cooled. The motor is especially suited for automatically controlled apparatus, such as refrigerators, oil burners, etc.

The thermostat has but one moving part, consisting of a circular bi-metallic disk which buckles at different temperatures. When buckling occurs, a multiplicity of contacts are opened at a predetermined temperature and when the disk cools down, they are closed. This action occurs when the disk itself reaches the operating temperature, regardless of how the heat is supplied.

Van Keuren Rectangular Gage-Blocks

Precision gage-blocks of rectangular shape are now being introduced on the market by the Van Keuren Co., 12 Copeland St., Watertown, Mass., in a complete series from 0.050 inch to 4 inches in length. These gages are available individually for replacing worn blocks in a thirty-three block ten-thousandths of an inch combination set for departmental or small shop requirements, and in the complete eighty-one block set here shown.

The gage-blocks are made of a long wearing alloy steel that is thoroughly seasoned. They are held to within a tolerance of

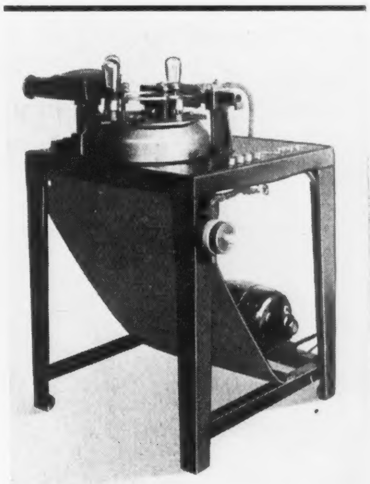
Eighty-one Block Set of Van Keuren Rectangular Gage-blocks

eight millionths of an inch, and are guaranteed as reliable standards of length at 68 degrees F.

Branding Machine for Plastic Products

Various methods of marking parts made from plastic materials were referred to in an article published on page 496-C of March MACHINERY. A gas-heated die is employed in a machine developed by the York Electric & Machine Co., 30-40 N. Penn St., York, Pa., for marking the bases of radio tubes and other round molded plastic parts. The radio tubes are indexed past the die and then past a wire brush that polishes the material raised in the marking. During the actual marking, the die moves with the part. From 1200 to 1500 parts an hour can be branded on this machine.

The same concern has also designed an electric branding machine which will mark surfaces up to 17 by 11 inches. This machine is somewhat similar in design to a printing press. The temperature used in both machines depends upon the materials being branded.

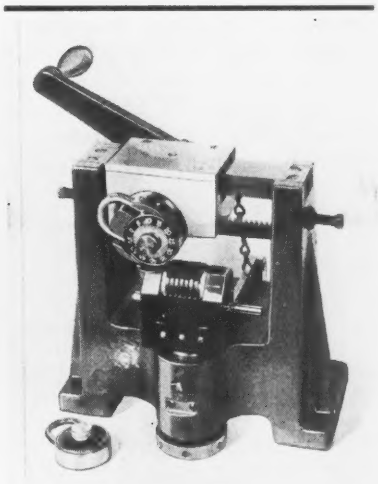


Plastic Products Marking Machine with Gas-heated Die

Serial Number Marking Machine

A bench type machine designed especially for marking serial numbers on locks and similar articles has just been developed by the Noble & Westbrook Mfg. Co., 20 Westbrook St., East Hartford, Conn. It will be seen from the illustration that the lock or other part is placed on a device connected directly to the handle of the machine. By turning the handle, the lock is carried over the numbering head.

The numbering head is located below the article being marked, thus enabling the operator to keep a convenient check on the numbers. During the return stroke of the handle, after the numbers have been rolled on the work, the wheels in the head are automatically advanced to the next higher number.



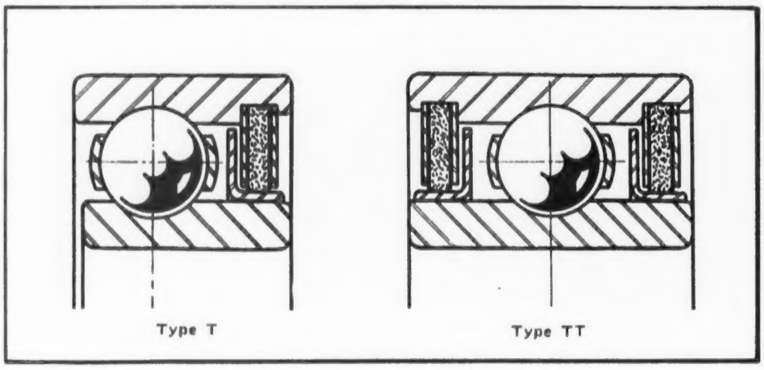
Bench Machine for Numbering Locks Serially

Fafnir Single and Double Felt-Seal Ball Bearings

Ball bearings with a felt seal on one side have been made by the Fafnir Bearing Co., New Britain, Conn., for several years, and have previously been illustrated in MACHINERY. The concern has now developed a line of bearings with a felt seal on one or both sides, as here shown. The two styles are known as Type T and Type TT, respectively.

The advantages claimed for using bearings of these types, having integral felt seals, as against standard ball bearings, when closures must be provided by the machinery manufacturer, are as follows: Reduced machining cost; prolonged lubricant life; compactness; quick assembly; easy disassembly; and effective sealing.

The bearings are made in twelve sizes. They are especially applicable to small high-speed equipment, such as electric motors, pumps, portable tools, refrigerators, and vacuum cleaners. The bearings are wrapped in cellophane.

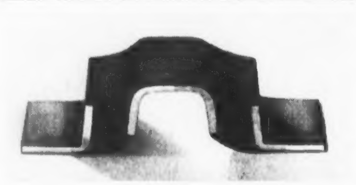


Fafnir Ball Bearings with Single and Double Felt Seals

Firestone Vibration Dampeners

Combination rubber and metal shapes of the design illustrated have been placed on the market by the Firestone Tire & Rubber Co., Akron, Ohio, for use beneath the legs or bases of machinery to absorb vibration and to eliminate noise. The shapes are made in lengths of 12, 24, and 36 inches. They can be cut to the required length by the customer and drilled. The illustration shows a short sample.

These "vibration dampeners" carry the load in compression when used as mentioned, the load resting directly on top of the shape, but they will also carry the load in tension or in shear.

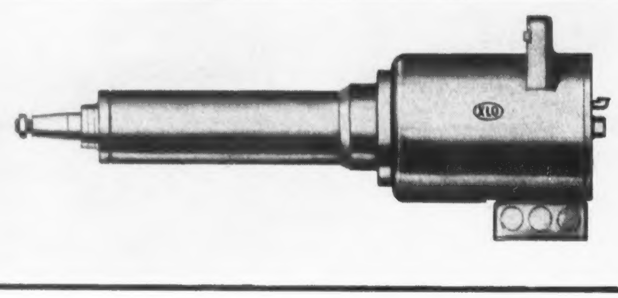


Firestone Rubber and Metal Shape for Absorbing Machine Vibration

In-Built Motor-Driven Spindle for Surface Grinders

The Ex-Cell-O Aircraft & Tool Corporation, 1200 Oakman Blvd., Detroit, Mich., has placed on the market an in-built motor-driven grinding spindle designed for use on the No. 3 Abrasive surface grinder. The rotor of the motor is mounted directly on the spindle, thereby eliminating the need of couplings or other driving means between the motor and the spindle.

The motor is balanced and has a rating of 1 horsepower. It can be furnished for 220-, 440-, or 550-volt, three-phase, 50- or 60-cycle current. Ex-Cell-O precision ball bearings are used throughout, except on the outer end of the motor, where an oilless bearing is provided.

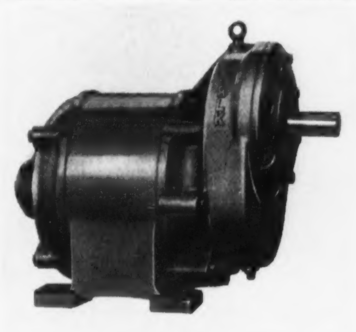


Motor-driven Spindle for the No. 3 Abrasive Surface Grinder

Falk Geared-Head "Motoreducer"

A combined motor and gear unit especially designed for relatively high ratios of speed reduction or speed increase has been placed on the market by the Falk Corporation, Milwaukee, Wis. This geared-head "Motoreducer" makes possible the use of high-speed motors instead of the more costly slow-speed type. It provides any desired speed from one-ninth up to about two and one-half times the motor speed. The variation in speed is obtained by means of a single pair of helical gears.

The motor frame supports the gearing, the housing for which is connected to and supported by the stator. The take-off shaft is generally located directly above the center of the motor, but it can be positioned at either side or below. The slow-speed shaft



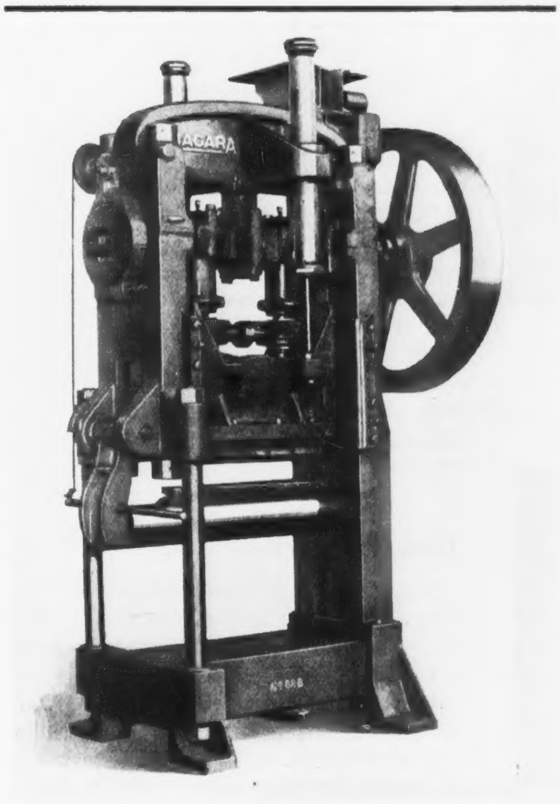
Falk Geared-head "Motoreducer" for Reducing or Increasing Speeds

is carried in Timken roller bearings. The pinion end of the motor is mounted in a solid roller-type bearing, the roller assembly being carried by an outer bearing race.

Niagara Horn Press for Side-Seaming Operations

A double-crank horn press designed for side-seaming metal drums has been added to the equipment built by the Niagara Machine & Tool Works, 637-697 Northland Ave., Buffalo, N. Y. The machine illustrated is equipped with a duplex side-seaming horn for making hooks and closing the side seam of the drum bodies. Adjacent edges of the body cylinders are folded, one up and one down, at the first stroke of the press slide. At the second stroke, the previously assembled hooked edges are closed by bumping together, there being provision for offsetting the seam either on the inside or outside.

Similar equipment can be provided for producing the Gordon or compound side seam. In that case, two channel-shaped edges are formed at the first stroke, and the assembled edges are closed at the second stroke to complete the seam.

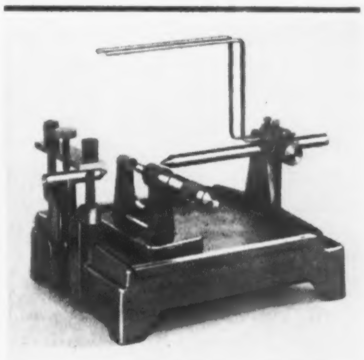


Niagara Double-crank Press Equipped with Duplex Side-seaming Horn

The horn is supported at both ends. It is designed to permit the side-seaming of work of relatively small diameter. The swinging latch which supports one end of the horn must be closed before the press can be tripped. An interlocking treadle and single-stroke attachment are available for controlling the clutch. These safety features prevent a working stroke from taking place until the drum body has been correctly positioned.

B & S Three-Wire Thread-Measuring Fixture

A handy fixture for measuring screws and other externally threaded parts on which commercial tolerances may be allowed has been placed on the market by the Brown & Sharpe Mfg. Co., Providence, R. I. This fixture is particularly useful for checking both short and long taps having an even number of flutes. It also provides a convenient means of checking external thread gages when the highest degree of accuracy is not demanded.



Three-wire Thread-measuring Fixture for Parts up to 2 Inches

The fixture has a measurement range from 0 to 2 inches. It is furnished with two micrometers, one for reading from 0 to 1 inch and the other from 1 to 2 inches. The micrometers float on steel balls, thus permitting the anvil to be squared with the measuring wires, so that the work need be placed in approximate alignment only. The micrometers are graduated to one-half thousandths of an inch. Estimates can thus be easily made to one-quarter thousandths of an inch.

The part to be measured is held between a center and a V-slide, the latter being adjustable to accommodate parts from 3/16 inch to 1 3/4 inches in diameter. An auxiliary short center can be used in the V-support as illustrated. One end of this center is bell-mouthed to facilitate holding very short taps and taps with pointed ends.

U. S. Varidrive and Syncrogear Motors

A squirrel-cage motor and variable-speed differential mechanism made up of "Variduscs" and

a "Varibelt" comprise a "Varidrive" motor developed by the U. S. Electrical Mfg. Co., Los Angeles, Calif. This unit is shown in Fig. 1. Differential disks reciprocally expand and contract for higher or lower speeds and transmit power through the Varibelt to the take-off shaft.

The output speed of this electro-mechanical unit can be increased or decreased instantly to any speed over a wide range while the driven machine is in motion. Variations as fine as one revolution per minute can be made. A full turn of the handwheel alters the speed 120 revolutions per minute. The speed of the rotor is constant. Variable-speed combinations from 25 to 10,000 revolutions per minute are available.

The same company has also brought out the Syncrogear motor illustrated in Fig. 2, which is a self-contained geared transmission that will give any speed from 2 to 10,000 revolutions per minute. The gears are of the helical type.

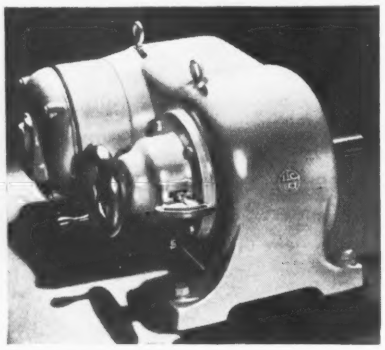


Fig. 1. Varidrive Motor—an Electro-mechanical Unit that Gives Any Speed over a Wide Range

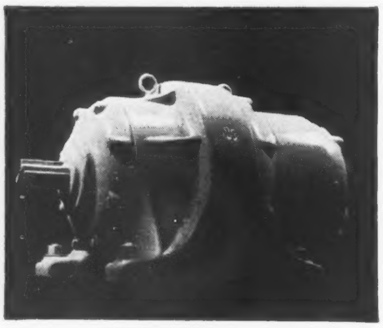


Fig. 2. Syncrogear Motor for Speeds from 2 to 10,000 Revolutions per Minute

Emerson Three-Horsepower Motors

A line of three-horsepower motors is being introduced to the trade by the Emerson Electric Mfg. Co., 2018 Washington Ave., St. Louis, Mo. These motors operate at 1725 revolutions per minute. They are available in the single-phase repulsion start, induction type; the polyphase squirrel-cage type; and the direct-current compound-wound type. The motors are designed to operate continuously without overheating. The ventilating openings are so arranged that protection is afforded against damage from dirt or water falling from above.

Emerson Three-horsepower Motor Made in Various Types

These motors, as well as others that the concern manufactures in ratings from 1/250 horsepower upward, can be made with electrical or mechanical details different from stock models to suit special requirements.

Boston Speed Reducers

Two standardized speed reducers recently added to the large line manufactured by the Boston Gear Works, Inc., North Quincy, Mass., are illustrated in Figs. 1 and 2. The LD compound worm-gear type, shown in Fig. 1, is especially adapted for transmitting power to slow-moving mechanisms, such as small stoker drives and conveyor drives. It is available in ratios from 37.5 to 1 up to 1740 to 1. Timken tapered roller bearings are provided. The threads of the hardened steel worm are ground.

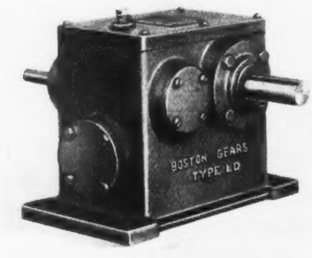


Fig. 1. Boston LD Compound Worm-gear Speed Reducer

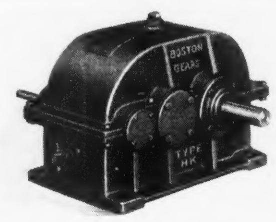
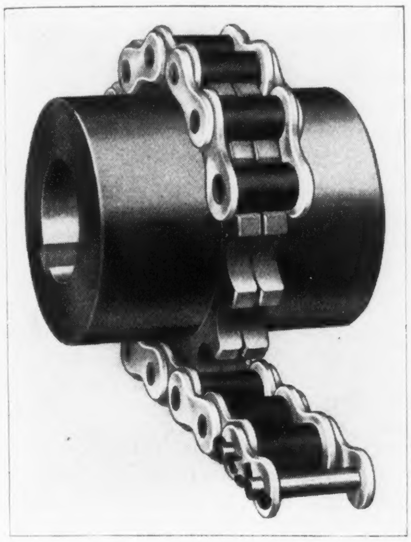


Fig. 2. Compound Helical-gear Type HK Speed Reducer

The HK compound helical-gear reducer, shown in Fig. 2, is also assembled from standard parts. It can be supplied in ratios from 9.79 to 1 up to 84 to 1. This speed reducer is also equipped with Timken tapered roller bearings. Ample lubrication of all moving parts is insured by the splash system.

Flexible Coupling which Uses Silverlink Roller Chain

A flexible coupling has been brought out by the Link-Belt Co., Indianapolis, Ind., which consists simply of two cut-tooth sprocket wheels connected, as illustrated, by a piece of the RC Silverlink roller chain described in January MACHINERY, page 361. All working surfaces are machined to close tolerances. A pin-and-cotter link makes it easy to couple or remove the chain. In installations



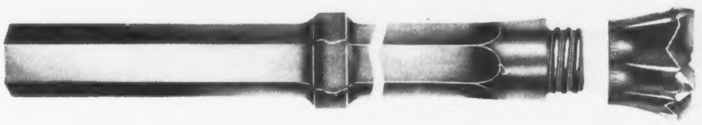
Flexible Coupling Made of Two Sprockets and Silverlink Roller Chain

requiring protection from dust, dirt, or other foreign matter, the coupling can be enclosed in either a stationary or revolving casing that is automatically lubricated and retains the oil.

Timken Rock Drill with Removable Bit

A rock drill that will be of interest to those in charge of machine erection and plant maintenance has been brought out by the Timken Roller Bearing Co., Canton, Ohio. The chief feature of this drill is the removable bit, which can be easily replaced when it becomes too dull for further service.

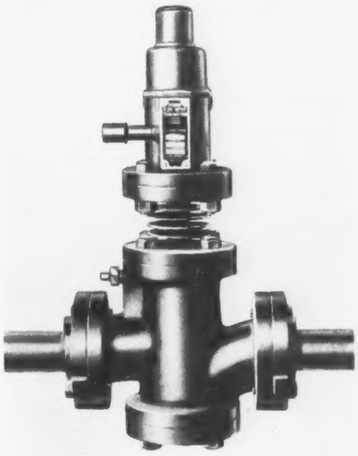
The bit is assembled tightly against an upset shoulder on the steel shank by means of a special thread. Being left-hand, the thread is opposed to the direction of shank rotation, and thus the bit is held tightly against the shoulder in drilling operations. Hammer blows are transmitted through the shoulder of the shank to the body of the bit rather than through the thread. The bit is forged from an alloy steel and heat-treated.



Timken Rock Drill with a Removable Bit that Provides for Easy Replacement

Brown Area-Type Flow Meter

The area-type flow meter here illustrated has been developed by the Brown Instrument Co., 4485 Wayne Ave., Philadelphia, Pa., for measuring the flow of certain fluids, such as viscous oils. In the steel industry, the instrument can be used for such applications as keeping a check on the amount of fuel used in the operation of open-hearth furnaces. Seals or auxiliary piping is not required between the meter body and the pressure taps, because the meter body is installed directly in the pipe line. If the oil will flow through the pipe, it will flow through the meter body.



Brown Flow Meter Designed for Measuring Heavy Oils and Similar Fluids

The meter body is of the piston-and-sleeve type. An inductance bridge system, such as is used in the Brown electric flow meter, transfers the motion of the piston to the recording or indicating meter. The meter is designed to be accurate whether the flow of fluid is small or large.

A New Nickel-Chromium Chilled Cast Iron

An extremely hard, tough, and strong chilled cast iron has recently been developed. As stated by Dr. P. D. Merica of the International Nickel Co., this new white or chilled cast iron is produced by alloying a good base composition of white cast iron with from 4 to 6 per cent of nickel and from 1 to 2.5 per cent of chromium.

This material can attain a hardness of from 600 to 750 Brinell, as against from 380 to 530 Brinell for corresponding grades of ordinary chilled iron. The strength of the material is also approximately doubled. The toughness is greatly increased and the wear-resisting qualities multiplied from four to ten times.

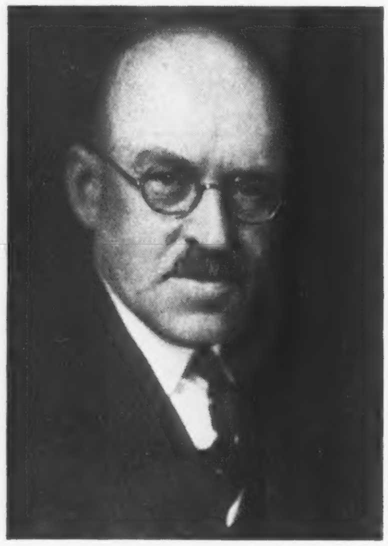
By a slight modification of the material, chilled wheels have been produced for street railway and mine car wheel service. These wheels show greater wear resistance to the application of brakes, and the occurrence of flat spots is reduced. Another application has been for rolling-mill rolls. In a simple casting, such as a sandblast nozzle, a resistance to wear or from five to six times that of plain chilled iron has been obtained.

NEWS OF THE INDUSTRY

F. C. EIBELL, who for the last four years has been manager of the advertising and publicity department of the Worthington Pump & Machinery Corporation at New York City, has resigned.

New England

RALPH E. FLANDERS has been elected president of the Jones & Lamson Machine Co., Springfield, Vt., succeeding JAMES HARTNESS, who has retired. Mr. Flanders received his early mechanical training as an apprentice with the Brown & Sharpe Mfg. Co., where he started in January, 1897. In 1905, he became associate editor of MACHINERY, and in 1910, engineer with the Fellows Gear Shaper Co. In 1912, he went to the Jones & Lamson Machine Co. as manager of the Fay Automatic department, and in 1914, was made manager of the company, later becoming vice-president. Mr. Flanders has served as president of the National Machine Tool Builders' Association and as vice-president of the American Society of Mechanical Engineers; he is also a member of the National Screw Thread Commission. Mr. Flanders has given much attention to economic subjects and is the author of the book "Taming Our Machines," as well as of numerous articles on economic problems that have been published during recent years.



Harris & Ewing

Ralph E. Flanders, Newly Elected President of the Jones & Lamson Machine Co.

FARREL-BIRMINGHAM CO., Ansonia, Conn., at a recent meeting of the board of directors, elected Franklin Farrel, Jr., chairman of the board; Nelson W. Pickering, president; and David R. Bowen, Carl Hitchcock, Franklin R. Hoadley and Armin G. Kessler, vice-presidents. Frederick M. Drew, Jr., was elected treasurer, and George C. Bryant, secretary.

SCOVILL MFG. CO., Waterbury, Conn., has been licensed by the Dardelet Threadlock Corporation, 120 Broadway, New York City, to manufacture and sell "Rivet-Bolts" and other bolts and nuts with the Dardelet self-locking thread.

New Jersey and New York

DR. EDWARD WESTON, founder and chairman of the board of the Weston Electrical Instrument Corporation, Newark, N. J., has been awarded the 1932 Lamme Medal of the American Institute of Electrical Engineers "for his achievements in the development of electrical apparatus, especially in connection with precision measuring instruments." Dr. Weston was born in England in 1850, and came to the United States in 1870. He incorporated the Weston Co. in 1877, and the Weston Electrical Instrument Corporation in 1888.

CALLAHAN CAN MACHINE CO., INC., 80 Richards St., Brooklyn, N. Y., has acquired the assets, including trade-marks and trade names, of the ADRIANCE MACHINE WORKS, INC., of Brooklyn. The Adriance Machine Works were originally organized in 1888 and incorporated in 1913. The products of the company include presses, dies, machinery for working sheet metal, automatic can machinery, and machinery for making crown caps, as well as special machinery. The new corporation will continue the manufacture of this line of equipment and will carry in stock repair parts for all Adriance machines now on the market.

GENERAL AIR CONDITIONING CO., INC., has been organized with offices at 155 E. 44th St, New York City, and offers complete engineering service in the design and installation of all classes of industrial air conditioning, air cooling, and drying systems. M. Hitchen will be president of the new concern; A. H. Clogston, vice-president; and David H. Knowles, secretary.

COOLIDGE SHERMAN has been appointed assistant general sales manager of the Ludlum Steel Co., Watervliet, N. Y. Mr. Sherman has held various positions in the Ludlum sales organization since his graduation from Yale University in 1916. He will continue to be located at the executive offices in Watervliet.

TRIPLEX MACHINE TOOL CORPORATION, New York City, announces its removal from 50 Church St. to new and larger quarters in the World-Telegram Bldg., 125 Barclay St.

New Mexico

CHAIN BELT CO., Milwaukee, Wis., has appointed the R. L. Harrison Co., Inc., of Albuquerque, New Mexico, distributor for the complete line of Rex construction equipment.

Ohio

FOSDICK MACHINE TOOL CO., Cincinnati, Ohio, manufacturer of radial and upright drilling machines, announces that N. B. CHACE has retired from the presidency of the company, after sixteen years of service in that capacity, to devote himself to other business interests. GEORGE G. KING has succeeded Mr. Chace as president of the company, with F. C. TUTTLE as secretary and treasurer, and W. R. HOFMANN as manager. Messrs. King and Tuttle are, respectively, president, and vice-president and treasurer, of the Peters Cartridge Co., which company owns the Fosdick Machine Tool Co. Mr. Hofmann has been identified with the company for many years in an executive capacity.

J. A. FAY & EGAN CO., Cincinnati, Ohio, builder of woodworking machinery, announces that at the recent annual meeting S. M. BLACKBURN, formerly vice-president and general manager of the John B. Morris Foundry Co., and vice-president of the Morris Machine Tool Co., was elected president and general manager. CLIFFORD P. EGAN was elected vice-president, and ESPY BAILEY was elected secretary and treasurer. FORREST T. CRANE was reappointed general sales manager, and PAUL M. MAHLER foreign sales manager. The company is the oldest woodworking machinery manufacturer in the United States, having celebrated its one-hundredth anniversary in 1930.

EARL C. SMITH, chief metallurgical engineer of the Republic Steel Corporation, Youngstown, Ohio, addressed a meeting of the American Society for Steel Treating at Muncie, Ind., March 1, on "Alloy Steels from the Manufacturer's Viewpoint." Mr. Smith dealt with the factors affecting the manufacture, treatment, and application of alloy steels of generally used analyses. He spoke on the same subject at the meetings of the Society at Buffalo, N. Y., on March 8, and at Rochester, N. Y., on March 9. Mr. Smith has been associated with the alloy-steel industry for many years and is an acknowledged authority on alloy steels.

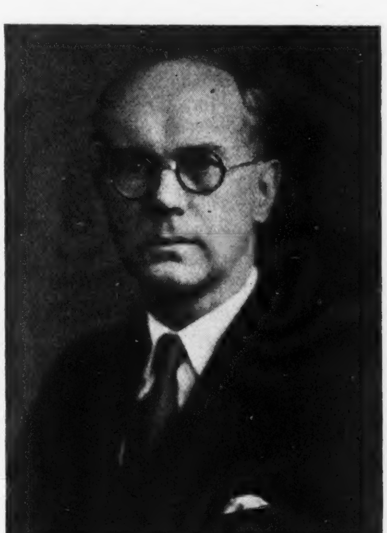
Lincoln Electric Co., Cleveland, Ohio, announces that the company will offer a course in designing for welded construction in cooperation with the John Huntington Polytechnic Institute in Cleveland. The course begins April 3 and consists of one week of intensive work. Enrollment is limited to thirty men. Further information can be obtained from E. W. P. Smith, consulting engineer, Box 683, Cleveland, Ohio.

B. F. Goodrich Rubber Co., Akron, Ohio, has appointed Lucien Q. Moffitt, Inc., Peoples Bank Bldg., Akron, Ohio, exclusive distributor for Goodrich "Cutless" rubber bearings in the United States and Canada. Lucien Q. Moffitt has been manager of the "Cutless" rubber bearing department of the Goodrich company since this new development in water-lubricated bearings was first announced several years ago.

E. A. Muller, president of the King Machine Tool Co., Cincinnati, Ohio, and first vice-president of the National Machine Tool Builders' Association, will assume the duties of president of the Association succeeding Henry S. Beal. Mr. Beal has resigned because he has been elected president of the Sullivan Machinery Co., and will no longer be engaged in the machine tool industry.

Pennsylvania

J. M. Hipple has been appointed general manager of merchandising engineering of the Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa. In this position, Mr. Hipple will have charge of the appliance, motored appliance, and refrigeration engineering departments, in addition to the radio engineering department at the Chicopee Falls Works, the small motor engineering department at the East Springfield Works, and the industrial heating engineering department at the Mansfield Works. Mr. Hipple entered the Westinghouse organization in 1898, upon graduating from the Ohio State University with the degree of mechanical engineer. He has served the company in various capacities, previously having been general works manager.



J. M. Hipple, General Manager of Merchandising Engineering, Westinghouse Electric & Mfg Co.

T. I. Phillips has been made works manager of the East Pittsburgh Works of the Westinghouse Electric & Mfg. Co. Mr. Phillips, formerly works manager of the Nuttall plant of the company, in addition to his new duties of factory management and operation, will remain in charge of the Nuttall plant in a supervisory capacity. He is replacing C. H. Champlain, who has been appointed general works manager of the parent company. To fill the position left vacant by Mr. Phillips' promotion, W. Oswald has been appointed superintendent of the Nuttall plant.

T. I. Phillips, New Works Manager of Westinghouse East Pittsburgh Works

L. H. Gilmer Co., Philadelphia, Pa., manufacturer of belts and belting, announces the following additions to its sales force: Frank Cuyler and Walter Manton have been recalled and assigned to the Brooklyn and New York territory, respectively; W. Harry Taylor and E. C. Lindsay will operate in the Philadelphia area; Paul Wright in New Haven and lower Connecticut; C. V. Cook in and around Tampa; H. W. Brennan in the Boston section; J. A. Lyons in Providence and vicinity; W. J. Robinson in the Albany territory; and H. K. Reed in and around Allentown, Pa.

C. H. Champlain has been appointed general works manager of the Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa. In his new position, Mr. Champlain will supervise the management and operation of the nation-wide plants of the Westinghouse company. He has been connected with the company since 1898, when he entered the organization as a machinist, and has risen steadily to his present position.

C. H. Champlain, New General Works Manager of Westinghouse Organization

The Philadelphia Power Transmission Club has just been organized with C. Carter Bond, president (Charles Bond Co.), Archie Chandler, vice-president (American Pulley Co.), Herman Cope, secretary and treasurer (J. E. Rhoads & Sons), as principal officers. The purpose of this group is to meet twice monthly for the study and discussion of group drives and power transmission problems. The method of making these studies will be to take up one by one the case studies made by Victor A. Hanson, research engineer for the Mechanical Power Engineering Associates. The members of the group thus far are: Charles Bond Co., J. E. Rhoads & Sons, American Pulley Co., L. H. Gilmer Co., E. F. Houghton & Co., Alexander Bros., R. L. Latimer Co., Sees & Faber Co., and Himmelein & Bailey Co.

Similar groups have been formed in Atlanta, Buffalo, Boston, New York, Detroit, Baltimore, and Chicago.

E. F. Houghton & Co., with plants in Philadelphia, Chicago, and Detroit, announce that they will manufacture and sell the products formerly made by the Weaver Bros. Co., Cleveland, Ohio, which include pickling and cleaning equipment. J. C. Weaver, formerly vice-president of the Weaver Bros. Co., is now manager of the cleaner and pickling products department of E. F. Houghton & Co.

Fred Waldorf, who has had many years of experience in sales engineering in connection with roller bearings, has been appointed district manager of the Pittsburgh district for the Bantam Ball Bearing Co., South Bend, Ind. The Pittsburgh office is located at 119 Gould Ave., N. S. Mr. Waldorf will handle the sales in the industrial line.

Illinois and Missouri

HENRY S. BEAL, formerly general manager of the Jones & Lamson Machine Co. and president of the National Machine Tool Builders' Association, has been elected president of the Sullivan Machinery Co., Chicago, Ill. Mr. Beal is a graduate of Dartmouth, and also studied at the University of Berlin. In 1909, he became associated with the Jones & Lamson Machine Co. Mr. Beal succeeds

Henry S. Beal, Newly Elected President of Sullivan Machinery Co.

ARTHUR E. BLACKWOOD, who has served as president of the Sullivan Machinery Co. since 1928 and now becomes chairman of the board.

NYE TOOL & MACHINE WORKS, 4120 Fullerton Ave., Chicago, Ill., announce that the board of directors of the company, consisting of Harry G. Nye, Jr., O. S. Lee, secretary and general manager of the company, and William J. Grede, president of the Liberty Foundry, Inc., Wauwatosa, Wis , and of the Spring City Foundry Co., Waukesha, Wis., will continue to direct the policies of the business along the same progressive lines as were followed by the late Harry G. Nye, founder of the company, who recently passed away. O. S. Lee, who has been associated with Mr. Nye for the last twenty years, and who for several years has had charge of the general management, will continue in that capacity. Mr. Nye's son, Harry, Jr., who has been closely associated with his father during the last two years, will continue to be personally active in the company. Mr. Nye's interest in the business will be retained by his family.

BARBER-COLMAN CO., Rockford, Ill., manufacturer of milling cutters, hobs, hobbing machines, hob sharpening machines, reamers, reamer sharpening machines, etc., has recently effected two changes in offices in New England and Chicago. To maintain direct factory representation in New England, F. R. Ridgley will have an office with the Barber-Colman Co. of Massachusetts at Framingham and will cover Massachusetts, Rhode Island, and a portion of Connecticut. In Chicago, the office of the machine and small tool division of the company will be merged with that of the electrical division and will henceforth be found at Suite 718, LaSalle-Wacker Bldg., 221 N. LaSalle St. Clinton S. Morey will be the representative.

A. S. KENNEDY has been appointed manager of the new branch office of the Chain Belt Co. in Kansas City, Mo. Rex chains and conveyors were formerly marketed in this territory through the St. Louis office. For the last five years, Mr. Kennedy has been a sales engineer, handling a general line of power transmission, elevating, and conveying equipment. The part of the Chain Belt line that will be handled by the new office will include Rex chains, power transmission equipment, elevators, conveyors, traveling water screens, sanitation equipment, and Stearns belt-conveyor idlers.

Michigan

STERLING-FRENCH MACHINERY CO., New Center Bldg., Detroit, Mich., has been organized to handle production machine tools in the Detroit territory, as well as in the Province of Ontario where a branch office will be maintained. Charles E. French is president of the company. Other members of the organization are: T. C. McDonald, formerly with the Reed-Prentice Corporation and the National Automatic Tool Co.; J. E. Livingstone, Michigan representative for the American Broach & Machine Co.; and D. B. Burleigh, vice-president and formerly sales manager of the Sundstrand Machine Tool Co.

CADILLAC MACHINERY CO., 623 Fisher Bldg., Detroit, Mich., announces that at the annual stockholders' meeting Colin L. Campbell, Thomas Redmond, Kennedy H. Crumrine, Charles Robertson, and Edward Busch were elected directors. Thomas Redmond was elected president; Kennedy H. Crumrine, vice-president; Edward Busch, treasurer; and Frank Donovan, secretary.

D. B. BURLEIGH, vice-president and sales manager of the Sundstrand Machine Tool Co., Rockford, Ill., will leave that organization early in April to join the Sterling-French Machinery Co., New Center Bldg., Detroit, Mich., as manager of lathe and milling machine sales.

KINGSBURY MACHINE TOOL CORPORATION, Keene, N. H., manufacturer of high-production automatic drilling and tapping machines, has appointed the Riordon Machinery Co., 213 Curtis Bldg., Detroit, Mich., its exclusive representative in the Detroit district.

Washington, D. C.

PATENT & TECHNICAL INFORMATION SERVICE, 1336 New York Ave., N. W., Washington, D. C., has recently been organized to supply technical information to manufacturers, development engineers, and research workers. The service includes making research through the Patent Office records, as well as securing technical data obtainable in the many government bureaus in Washington.

S. DOUGLAS GIBSON has been placed in charge of the Washington office of the Bantam Ball Bearing Co., South Bend, Ind., which is located at 1108 W. 16th St., Washington, D. C. Mr. Gibson will serve as contracting engineer for the government sales department.

COMING EVENTS

APRIL 26-28—TWENTIETH NATIONAL FOREIGN TRADE CONVENTION to be held at Pittsburgh, Pa. Eugene P. Thomas, secretary, 1 Hanover Square, New York City.

APRIL 27-28—Annual meeting of the AMERICAN WELDING SOCIETY in New York City. Miss M. M. Kelly, secretary, 29 W. 39th St., New York City.

MAY 4-6—Annual meeting of the AMERICAN GEAR MANUFACTURERS' ASSOCIATION at Wilkinsburg, Pa. J. C. McQuiston, manager-secretary, First National Bank Bldg., Wilkinsburg, Pa.

MAY 8-11—Annual meeting of AMERICAN SUPPLY & MACHINERY MANUFACTURERS' ASSOCIATION at Louisville, Ky. R. Kennedy Hanson, secretary-manager, Clark Bldg., Pittsburgh, Pa.

JUNE 12-16—TENTH NATIONAL OIL BURNER SHOW in Chicago, Ill. Harry F. Tapp, executive secretary, American Oil Burner Association, Inc., 342 Madison Ave., New York City.

JUNE 19-23—Annual convention and exposition of the AMERICAN FOUNDRYMEN'S ASSOCIATION at the Hotel Stevens, Chicago, Ill. C. E. Hoyt, executive secretary-treasurer, 222 W. Adams St., Chicago, Ill.

JUNE 25-30—SIXTH MIDWEST ENGINEERING AND POWER EXPOSITION in the Coliseum, Chicago. Exposition headquarters, 308 W. Washington St., Chicago, Ill.

JUNE 26-29—Semi-annual meeting of the AMERICAN SOCIETY OF MECHANICAL ENGINEERS at the Hotel Stevens, Chicago, Ill., during "Engineering Week." Calvin W. Rice, secretary, 29 W. 39th St., New York City.

JUNE 26-30—Annual meeting of the AMERICAN SOCIETY FOR TESTING MATERIALS at the Hotel Stevens, Chicago, Ill. C. L. Warwick, secretary-treasurer, 1315 Spruce St., Philadelphia, Pa.

OCTOBER 2-6—NATIONAL METAL CONGRESS AND EXPOSITION in Detroit, Mich., under the auspices of the American Society for Steel Treating. Secretary, W. H. Eisenman, 7016 Euclid Ave., Cleveland, Ohio.

OBITUARIES

Harry G. Nye

Harry G. Nye, founder and president of the Nye Tool & Machine Works, Chicago, Ill., died February 8, in his sixtieth year. Mr. Nye was born in Richmond, Ind., in 1873. He started in business for himself in 1904, and in 1906 incorporated the Nye Tool & Machine Works, Inc. The first shop was located on Canal St. in Chicago, later being removed to 108 N. Jefferson St. In 1925, the present plant at 4120 Fullerton Ave. was built.

Harry G. Nye

At first Mr. Nye manufactured pipe-threading dies, but later expanded the business into a complete line of plumbers' and steamfitters' hand tools, adding to this a line of electrically driven pipe-threading machines.

Mr. Nye's letters to the plumbing trade have been nationally known and appreciated for the last fifteen years. They attracted widespread attention because of his sound business logic, presented in a style of keen humor. One letter of appreciative comment was received by Mr. Nye from the late Calvin Coolidge, while the latter was president.

Frank Horsburgh

Frank Horsburgh, founder and president of the Horsburgh & Scott Co., Cleveland, Ohio, died, after a short illness, at his home in Cleveland, on March 4, aged seventy-eight years.

Mr. Horsburgh was born in Scotland, and came to Cleveland when he was twenty-five years old. In 1888 he entered into a partnership with Thomas Scott, the partners at first doing business as general millwrights and machinists. When electric street cars were introduced, the firm specialized in the manufacture of gears. In 1898, Mr. Horsburgh acquired Mr. Scott's interest and formed the present company.

Mr. Horsburgh was one of the founders of the American Gear Manufacturers' Association and acted as its treasurer for several years. He was one of the most highly respected members of the Association and a dean of the gear industry. He was also deeply interested in civic affairs and his own success contributed much to the growth and the welfare of the community. Mr. Horsburgh leaves two sons, T. P. and R. G. Horsburgh, who are connected with the Horsburgh & Scott Co. in the positions of vice-president and general manager, respectively.

CHARLES MACCAUGHEY SAMES, associate editor with the American Society of Mechanical Engineers, New York, died suddenly on March 8. Mr. Sames was born at Rockford, Ill., in 1865 and was a graduate of the Rose Polytechnic Institute. After graduation, he was connected with the Thomson-Houston Electric Co., Lynn, Mass., and later went into business with his father, who was a manufacturer of agricultural implements in Rockford. In 1900, he took up editorial work, compiling and editing the "Pocketbook of Engineering," published in 1905. He was later connected with the Engineering News Publishing Co., and in 1916 joined the staff of the American Society of Mechanical Engineers.

NEW BOOKS AND PUBLICATIONS

DESIGNING FOR ARC WELDING—Second Lincoln Arc-Welding Prize Competition Papers. Edited by A. F. Davis, divisional vice-president of the American Welding Society, and vice-president of the Lincoln Electric Co. 416 pages, 6 by 9 inches; profusely illustrated. Published by the Lincoln Electric Co., Cleveland, Ohio. Price, $2.50.

This book contains the prize-winning papers in the Second Lincoln Arc-Welding Prize Competition, in which $17,500 was distributed in forty-one prizes. This competition was eminently successful in bringing forth many new ideas in the design and manufacture of hundreds of varied products. The theme of the book may be said to be the cutting of costs by redesigning. The contents are divided into five main sections dealing, respectively, with the application of welding to the construction of machinery, ships, buildings and bridges, large containers, and piping and fittings. In each instance, the fundamentals of the design are so explained as to make the directions readily applicable to other industries. The use of arc-welded alloys to resist corrosion, the welding of steels of high tensile strength, and structural design for the resistance of earthquake shocks—these are a few of the unusual developments discussed.

Since this book contains the prize-winning papers in a competition, each chapter is written by an authority in his particular field, and the book summarizes the outstanding contributions of welding to industry during recent years. Each paper gives actual savings in costs and shows how the various savings were effected.

In this book, many instances are cited where tradition has been upset and old practices and processes subjected to critical and enlightened analysis. The result has been to throw open new channels of thought, leading to new and improved methods, and to further the advance of industrial progress.

EMPLOYE HANDBOOKS. 20 pages, 8 by 10¾ inches. Published by the Policyholders Service Bureau of the Metropolitan Life Insurance Co., 1 Madison Ave., New York City.

To acquaint employes with the ideas, methods, and policies of the organization they work for, many companies have published informative handbooks of varying types. The present pamphlet contains an analysis of the subjects discussed in these manuals, their physical make-up, and methods of distributing them. The material is based on a review of selected manuals.

Classified Contents of this Number

Your Progress Depends Upon Your Knowledge of Your Industry